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Review of soft flooring options for saleyards

Southern beef zone

Abstract

Industry commentators rate saleyard flooring and roofing as important and complementary. This report deals with flooring alone.

Poor saleyard flooring that harms cattle's health and welfare leads to bad publicity, consumer backlash and poor sales. With the enormous growth of the feedlot sector, the increasing pressure from national and international animal welfare groups and the resulting media interest, saleyards in southern Australia have an urgent requirement to present improved conditions for livestock (and also for staff). Lameness and associated issues have been identified as a major problem for some saleyards, to the point that it has impacted on their future viability.

This review was commissioned by Meat and Livestock Australia (MLA) as a means of evaluating the range of soft flooring options, and to identify their strengths and weaknesses for cattle saleyards throughout Australia's southern beef zone.

Saleyard stakeholders have been identified and a broad range of issues were surveyed which impact on each soft flooring option. These include animal welfare/foot soreness, bio-security risks, setup costs, maintenance, life expectancy, cleaning ease and cost, impact on the environment and OH&S issues.

This report provides a useful insight into the possible soft-floor options available to cattle saleyards operating in southern Australia. It provides information from buyers, yard operators/owners and transporters outlining their views on the different flooring types. It also contains flooring recommendations for saleyard operators and provides them with a simple Decision Support Tool for choosing the most appropriate soft-floor surfaces.

Executive Summary

Some saleyard operations in south-eastern Australia have addressed the problem of cattle lameness by laying down various soft standing materials. This has proven to be generally successful; however, there is room for improvement and scope for analysis of the full benefits of implementing this practice. Each saleyard is unique and prior to any flooring decision, the people responsible must consider their number of stock, weather conditions, replacement policies and post-saleyard uses.

The majority of southern Australian saleyards are owned and run by local councils and little has been done to change their infrastructure and management since construction on average some 30 years ago. Soft flooring is a standard required today by many buyers for these existing venues to remain competitive. Together with roofing, it has been adopted as the standard in any recent construction.

This review was commissioned by MLA to identify and assess soft-floor options for cattle saleyards in Australia's southern beef zone. The southern beef zone in this report refers to New South Wales, Victoria, South Australia and south of Geraldton in Western Australia.

During the survey and interview processes conducted for this review, six soft-floor options were identified; all of these are currently in use across southern Australia. They are woodchip, woodchip/sawdust mix, sawdust, rubber matting, sand and natural earth/gravel. These have been compared to concrete, the hard floor option.

Research methods used for this project included consultations with key affected industry personnel such as cattle buyers and saleyard owners/managers. Other methods included acquiring expert opinions, the analysis of surveys, comparisons with analogous cattle yarding/housing systems (such as feedlots and dairy calving pads) and a literature review.

This report highlights the issues impacting flooring such as animal welfare/foot soreness, bio-security risks, setup costs, maintenance, life expectancy, cleaning ease, and impact on the environment and OH&S.

To summarise, the surveys indicated that 75% of cattle buyers would prefer to buy stock from a saleyard with a soft-standing floor. But there are concerns about dust, mud and slush, and the longevity of rubber matting and gravel. Currently, sawdust and woodchip are the two favoured saleyard floor surfaces for cattle buyers. Data shows sawdust has a density of 225kg/ cubic metre and an absorption rate of 2.5kg/kg. This is very efficient in reducing accidents due to slippage.

The limitations of surveying for accurate and reliable information are acknowledged. The opinions of stakeholders on soft flooring are imperative for effective market research, however it should be recognised that respondents may not be aware of all issues such as the possible disease risks associated with some soft-floor material. The literature suggests that the increase in risk of spread of contagious disease between cattle and from cattle to man arising from the use of soft flooring within saleyards is small and that this increased risk is manageable if soft floor pens are well designed and maintained and if pen use is appropriate (i.e. appropriate age groups and cattle type to appropriate pens). Soft flooring that is well designed and maintained can significantly improve the animal welfare of cattle sold through saleyard and these benefits outweigh the increased biosecurity risk that these floors may pose.

The results of the survey from the saleyard operators are generally positive towards soft flooring. One of the main reasons given by respondents was that cattle are fresher, move more freely and travel better after standing on soft flooring.

A significant point however was that foot soreness is not solely related to concrete floors, but to cattle management, breed, transport time, stress and, importantly, individual animal temperament.

The saleyard industry has guidelines for the feeding, watering and space provisions for livestock as contained in the Model of Code of Practice for the Welfare of Animals, Animals at Saleyards, SCARM Report 3. The saleyard industry should develop a more comprehensive set of pen densities and adhere to recommended space allowances for penned livestock irrespective of the flooring type so that cattle receive adequate rest and minimise the risk that they are tired during transport. Overcrowding of pens can also increase the incidence of lameness.

The information gained from this research will provide all operators in the Australian southern beef zone a solid starting point for their ongoing development in the soft stand process. Unless supply chain issues are resolved and saleyards offer best practice standards, they risk their role diminishing.

Contents

1 Background

In southern Australia large numbers of weaner cattle are presented for sale through the saleyard system; these sales begin in late December and run through to April with the bulk of cattle being presented in January, the hottest time of year. As systems have changed due to requirements to weigh and comply with the National Livestock Identification Scheme (NLIS) process, cattle have had to spend ever-increasing amounts of time at saleyards. This extra movement and time required on concrete has lead to some animals becoming lame although an estimate of this number is not available. Lameness is a visual animal welfare problem (in general lame cattle are easier to detect than sick cattle). The minimisation of lameness within saleyards will improve animal welfare.

Lameness is a widespread ailment afflicting dairy cows (Rushen, Jeffrey et al, 2004). Dairy farmers tend to underestimate how many cows in the herd are lame. Research has shown that farmers, on average, are aware of only one out of three or four cows that are lame (Rushen et al, 2004). Cows become lame for a number of reasons, but mostly because of hoof lesions, resulting from infections (such as digital dermatitis), metabolic problems associated with laminitis, or from physical injury (such as bruises or excessive wear). Not all hoof lesions affect the gait of the cows sufficiently for lameness to be noticeable and many more cows suffer from hoof injuries or lesions than are obviously lame (Rushen et al, 2004). Results from buyer and stock agent surveys and other anecdotal information (Bruce Knee, pers.com) show that additional stress related to lameness is not only occurring in weaner cattle but across the full spectrum with heavier older cattle, particularly pregnant cows, and European breed cattle. It has been thought this is a result of the abrasive nature of the non-slip, corrugated concrete saleyard floors.

It is no longer just a profit adjustment for purchasers who have to deal with these problems but a problem reaching the animal welfare agenda. This has the potential for long-term impacts on saleyards and others in the cattle supply chain such as livestock transporters.

Prior to the first tentative trials of soft-standing floors, buyers expressed concern regarding the welfare of some cattle, particularly weaners purchased off cleated or marked concrete, commonly found in saleyards. Reports have been made of animals being put down on arrival at feedlots because of serious lameness and injury caused by collapsing and being trampled on in the trucks during transport. Several buyers stated that steps need to be taken to improve the welfare and presentation of livestock or they would be forced to boycott sales.

Lameness appears to be most profound and serious in young stock because presently the majority of young stock are purchased to grow out in feedlots, at pasture or for backgrounding prior to feed-lotting. This means they should be presented for sale in the best possible condition to ensure a rapid transition to their new environment. This can only be guaranteed if the animals are healthy and suffering as little stress as possible during the change of ownership.

Whilst hard flooring in the saleyard may be the primary cause of lameness, there are other factors such as breed, temperament, weight, the structure of the animal, the quality of the hooves and seasonal conditions which may accentuate the problem. Tristan Jubb, Department of Primary Industries, Bendigo Victoria, states in his paper “Lameness in Store Weaner Cattle “:

When recently purchased weaner cattle become lame there is a tendency to blame the hard floor surfaces of the saleyard through which they transited. However lameness, like all diseases, is caused by multiple factors combining at the same time. This is known as the multifactorial nature of

disease where animal, management and environmental factors interact to cause disease. Hard floor surfaces may or may not be the key predisposing factors causing lameness in weaner cattle after transiting saleyards.

Animal factors that predispose to lameness include poor temperament, soft feet and heavy body weight. Predisposing environmental factors include wet weather and rough, abrasive or sharp floor surfaces. Predisposing management factors include mixing of unfamiliar cattle, recent weaning, transportation and poor handling equipment.

The risk factors may combine to cause lameness at a number of points - on the farm of origin, during transport, in saleyards or at their final destination, the purchaser's farm. Many of the risk factors begin on farm and more accumulate as the animals move from one point to the next, the saleyards being a likely point where many of these factors have time to interact and take effect (Jubb, 2005).

Preventing lameness
What can saleyard operators do?

- Develop saleyard policies and procedures including risk management plans to identify and eliminate hazards in saleyards, particularly broken concrete, sharp edges and slippery surfaces;
- When designing or renovating yards, ensure there are adequate numbers of yards and space to prevent having to mix and redraft cattle;
- Seek professional advice on concrete yard floor design, particularly groove pattern design to minimise slip, trauma and improve drainage;
- Avoid using gravel in areas where it may be carried onto concrete floors;
- Decrease the number of corners in saleyards to minimise cattle twisting and turning;
- Place saleyard equipment (including NLIS readers) in strategic locations to minimise handling and movement of cattle; and
- Identify high-risk areas in yards (i.e. slippery, rough surfaces, sharp edges) and lessen exposure of high-risk cattle to them (i.e. reduce holding times).

2 Project objectives

This project's objectives required the provision of a report to MLA that covers:

- Identification of the various options for saleyard flooring across southern beef regions including existing and potential surfaces;
- The strengths and weaknesses of each flooring option, including setup costs (including freight), maintenance costs, useful life, cleaning ease and cost, impact on animal welfare/foot soreness (including biosecurity risk - i.e. risk of disease spread and transmission between different groups of animals), impact on OH&S of saleyard workers, and potential issues for environmental management; and
- Recommendations for saleyard operators, including a simple table of benefits and drawbacks for each surface, and development of a simple Decision Support Tool for choosing soft-floor surfaces.

3 Methodology

3.1 Project team

The project team comprises Ian Crafter, principal of Atlex Stockyards; Frank White, the principal of Livestock Exchange Consultancy; and Brendan Carey, the principal of Scanclear. This team has many years of direct involvement and exposure in the saleyard industry, as well as experience in undertaking previous research on various topics within the sector.

In addition, the project team co-operated with Bruce Knee, recently retired from the Victorian Department of Primary Industries, who has considerable experience with soft flooring in cattle yards.

Dr Simon Lott, CEO of EA Systems, who has worked in conjunction with Atlex Stockyards with the successful design and operation of the Greenfield Horsham Regional Livestock Exchange, was also consulted. Richard Shephard, a cattle veterinarian and director of Herd Health Pty Ltd, contributed specifically on animal health, welfare and biosecurity issues.

3.2 Distribution and analysis of surveys

A key focus was using surveys to discover the type of flooring that the clients of southern Australian saleyards expect now and in the future.

Saleyard user stakeholders were identified by the consultancy team as producers/vendors, transporters, stock agents, feedlotters and processors. A *Saleyard User* survey form and explanatory letter (see Appendix 1) was designed and forwarded to six peak bodies representing the above stakeholders (see “List of contributors to this report” in Appendix 2). Each body was asked to select a minimum of six of their members who buy stock out of a mix of soft-floored and concrete-floored saleyards in the southern beef zone and forward them the explanatory letter and the survey form. The bodies were invited to distribute more widely if they wished. From this distribution of a hypothetical minimum of 36, there were 16 respondents who could be grouped collectively as cattle buyers who buy for feedlots, processors, backgrounders and graziers. In addition, two transporters responded.

A separate *Saleyard Owner/Manager* survey form was also designed and distributed (see Appendix 3) to all cattle saleyard owners or managers in Australia’s southern beef zone. There were 20 respondents across four states.

Results from both surveys were analysed to present the data, and outcomes as quoted throughout this report.

In addition, ten vendors were surveyed (see Appendix 4) to ascertain that the majority of the cattle sold by them were sold through soft-floor saleyards.

3.3 Existing information

Existing information was researched and analysed as the project team wished to explore national and international trends. The international literature on flooring sourced included: American T. Jungbluth's (et. al.) "Soft Walking Areas in Loose Housing Systems", Swedish Christer Bergsten's "Lameness and Claw Lesions as Influenced by Stall Environment and Cow Comfort", American D.R. Bray's (et. al.) "Should the Rubber Meet the Road?", Canadians Jeffrey Rushen and Anne Marie de Passillé's "Environmental Design for Healthier and More Profitable Cows", and Jeffrey Rushen's (et. al.) "Designing Better Environments for Cows to Walk and Stand". (See Bibliography for details.)

A comprehensive series of studies of lameness in New Zealand dairy cows identified the following external (i.e. non-cow related) risk factors for lameness in pasture-based dairy herds:

- Poorly maintained track surfaces. Surfaces should be made of non-abrasive material and be well drained and formed to minimise lameness.
- Impatient movement of stock. Cattle should be moved without fear so they can select the landing site for each step (this minimises the risk of a penetrating wound to the sole) and to prevent excessive sole wear.

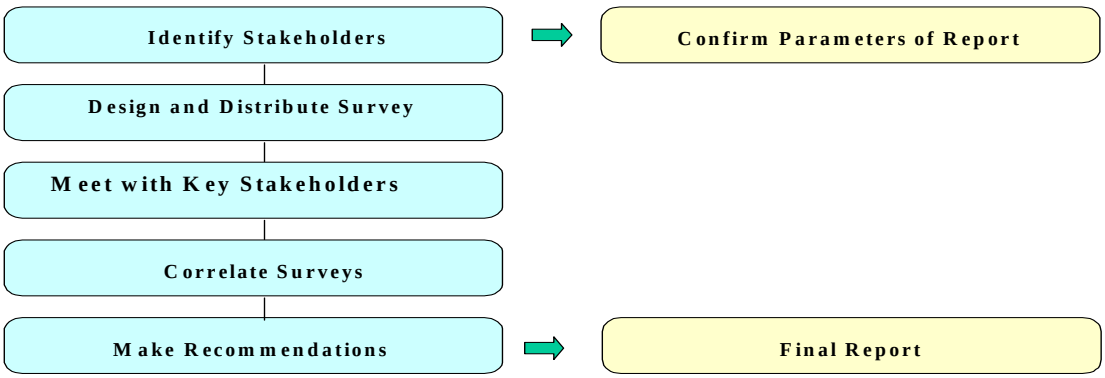
The hardness of feet was found to decrease as the moisture content of the hoof wall increased and moisture content increased during wet conditions. A reduction in feet hardness was found to result in an increased incidence of lameness in New Zealand dairy cattle (the peak period for lameness in New Zealand is spring).

3.4 General consultation

Individual interviews with key livestock industry personnel were also conducted. Face to face discussions enabled the project team to gain an understanding of the various needs and challenges each saleyard operator faces.

Figure 1 below is a diagrammatic representation of the methodology used in this project.

Figure 1 Diagrammatic representation of methodology



4 Factors considered

4.1 Animal health and welfare – including biosecurity

Improvements in animal health and welfare can often improve production and hence lead to economic benefits. The Australian Animal Welfare Strategy (August 2006) put together by the Commonwealth Department of Agriculture, Fisheries and Forestry recognises that animals under human care or influence must be properly fed and comfortable and that efforts are made to improve their well being and living conditions. In addition, there is a responsibility to ensure that animals that require veterinary treatment receive it, and that if animals are to be destroyed; it is done humanely (The Australian Animal Welfare Strategy, 2006).

Most Australian saleyards are proud to state that animal welfare and OH&S are a priority in the livestock handling community. As WorkCover has made methods and machines smarter, animal welfare has benefited. While today's saleyards are edging closer to best practice standards, soft flooring is a progressive step in the management process and for saleyards to stay in business they will need to be show places of best practice. The industry has also introduced the National Saleyard Quality Assurance program, which is a voluntary standard and is externally audited by AUSMEAT.

There are five internationally recognised 'freedoms', which provide valuable guidance to those in the livestock industry working towards animal welfare (The Australian Animal Welfare Strategy, 2006). These are:

1. Freedom from hunger, thirst and malnutrition;
2. freedom from fear and distress;
3. freedom from physical and thermal discomfort;
4. freedom from pain, injury and disease;
5. and freedom to express normal patterns of behaviour.

There is limited international research on short-term soft flooring and the effects on cow comfort, however the results of long-term housing can be translated, as there is evidence through our surveys of injury to cattle on hard floor surfaces and the preference of buyers, operators and transporters for cow comfort through use of soft floors.

"Cow comfort" includes lying comfort as well as comfort when the cow is standing and walking. The lying comfort can be divided into three important features: space for lying down and rising, comfort of the bed, and hygiene. Dr Christer Bergsten, the Associate Professor of the Swedish University of Agricultural Sciences, states that if animals are not lying down their feet will be exposed to environmental challenges, which may result in claw lesions and lameness (Bergsten, 2004). As well as concern for the welfare of the cow, in Swedish dairy systems lameness costs several hundred dollars per animal in terms of lost production, reduced reproduction, and veterinary care (Rushen and de Passille). While it is unlikely similar costs would occur in relation to use of concrete flooring in saleyards due to the limited time cattle are in these yards relative to housed dairy cattle it highlights the potential for production costs as well as welfare impacts from different flooring options.

In his study of dairy cows in free-stall barns, researcher Peter Best (Australian Nuffield Farming Scholars Association 2004) concluded that a major cause of lameness in housed cattle can be the loafing (resting) area design and over crowding (Best, 2004). If there is not sufficient room for lying down then the cows will be forced to stand for extended periods – leading to lameness. Peter Best

stated that studies in the US have found that in such production systems dairy cows need to lie down for at least 14 hours per day, so density can be critical.

This need for rest was reinforced by anecdotal evidence from a surveyed transport operator with a minimum of 870 loads annually out of saleyards, who commented that foot sore and tired cattle (cattle who are unable to adequately rest) do not travel well and often collapse in the truck, are trodden on, are bruised, or at worst - die in transit.

Some insight is possible from studies of the effects of floor composition in long-term housed cattle and from feedlots. A study of dairy cows found that they preferred to lie on straw and rubber matting over sand and their preference was for straw over rubber in winter (Manninen et al. 2002). Another dairy cow study demonstrated that cows had a distinct preference for walking on woodchip-surfaced laneways than for existing hard farm tracks (Gregory & Taylor 2002).

The heat flux to bedding is significant and can influence animal body temperature regulation. Cattle prefer to stand in hot weather because standing slows the increase of body core temperature (Hillman, Lee & Willard 2005). Conversely, lying can be an important mechanism that cattle use to conserve body heat in cold conditions but this will only occur when the lying surface has suitable thermal insulation properties. Sudden change to the thermal environments of cattle will increase stress levels with a resultant decrease in feed intake (Gaughan, Davis & Mader 2004; Silanikove 2000). Thermoregulation mechanisms can adapt to changes in ambient temperature over the longer term but these mechanisms are not effective during periods of sudden change in ambient temperature (Kennedy et al. 2005). Movement through a saleyard can represent a period of sudden change in thermal conditions for cattle and their adaptive processes are unlikely to be effective in the short term.

Housed cattle spend up to 50% of their time lying down and inability to allow cattle to either control body temperature within the required range or to lie for the required time is poor animal welfare (Ruunaniemi, Hautala & Ahokas 2005). Wet cattle are unable to maintain a warm layer of air within the coat and this compromises their ability to thermoregulate. Cattle with dry and thick winter coats can maintain their body temperature and dietary intake at ambient temperatures down to -7° C. Cattle with wet coats lose the ability to thermoregulate and maintain food intake when the ambient temperature falls below 15° C. Muddy floors within southern Australian saleyards are likely to inhibit lying activity and may reduce the capacity of cattle to thermoregulate during winter.

Concrete exposed to direct sunlight in summer can store significant amounts of heat. This may promote the development of (or exacerbate existing) laminitis within the hooves of cattle when exposed to hot concrete for prolonged periods. Prolonged exposure to hot concrete may also inhibit normal lying behaviour. Concrete floors in saleyards may prevent normal lying activity and can contribute to the development of lameness in transported and yarded cattle and both represent adverse animal welfare events.

Soft floors in saleyards may encourage lying activity and can help to minimise lameness in yarded cattle. However, surfaces must not become waterlogged as this will also prevent normal lying activity. Waterlogged soft floor surfaces in winter will contribute to the wetting of the coats of cattle inhibiting capacity of stock to maintain body temperature. Cattle that are yarded for prolonged periods (24 hours or longer) therefore require access to surfaces suitable for lying, access to shade in hot weather and dry comfortable surfaces in cold weather.

Calving pads and feedlots

Calving pads are small, built-up and often enclosed areas used for calving dairy cows within seasonally calving pasture-based dairy herds. Calving pads usually have bedding material (straw, rice hulls, wood chips, sawdust) provided to make cows more comfortable. They typically have very high stocking density and continual cow transitions into and out of the pad during the calving season. Feedlots house cattle (often from multiple sources) at high stocking densities in pens with various soft floor compositions. Animal welfare and biosecurity knowledge gained from studies of calving pads and feedlots are likely to be useful in considering saleyards with soft flooring. Comparisons with calving pads and feedlots are relevant, however these facilities generally don't have the same level of mixing of unfamiliar stock from many different backgrounds and the re-distribution of stock which could help spread any diseases.

Based on available information and experience, a summary of the impact of floor type on animal welfare is provided in Table 1.

Table 1 Impact of floor type on animal welfare

	Animal welfare		
Floor type	Lameness	Lying comfort	Thermoregulation
Woodchip	* (dry) ** (wet)	* (dry) *** (wet and cold)	* (dry) *** (wet and cold)
Woodchip / sawdust	* (dry) ** (wet)	* (dry) *** (wet and cold)	* (dry) *** (wet and cold)
Sawdust	* (dry) * (wet)	* (dry) *** (wet and cold)	* (dry) *** (wet and cold)
Rubber matting	* (dry) * (wet)	* (dry) * (wet and cold)	* (dry) * (wet and cold)
Sand	* (dry) *** (wet)	* (dry) *** (wet and cold)	* (dry) *** (wet and cold)
Earth / gravel	* (dry) *** (wet)	* (dry) *** (wet and cold)	* (dry) *** (wet and cold)
Concrete	*** (dry) *** (wet)	*** (dry) *** (wet and cold)	*** (hot and dry) **(wet and cold)

N.B. The number of stars denotes the level of animal welfare with * denoting best animal welfare and *** denoting worst animal welfare. (Dry) or (Wet) describes if the floor is wet or dry.

4.1.1 Biosecurity

Biosecurity refers to the measures put in place to protect livestock against the likelihood of entry and spread of diseases within cattle herds (Cattle Council of Australia Biosecurity or Disease Risk Mitigation Strategy for the Australian Cattle Industry). Biosecurity risk is a very specialised area largely outside the range of expertise of the surveyed group, and this report has relied on Animal Health Australia (AHA) in their *Guidelines for Managing BJD in Saleyards* (July 2005), and Richard Shephard, a cattle veterinarian and epidemiologist.

Biosecurity controls are in place to protect animal welfare, animal health and public health. Forbes Livestock Exchange was recently praised by Animal Health Australia's Director Programs, Dr Rob Keogh, for its level of biosecurity protection measures. The saleyard includes a soft stand floor made of compacted sawdust, rice hulls and sand (Saleyards Association Information Centre, 2006).

Adequate drainage and the regular removal of faecal contamination from calving pads have been identified as the key components for their successful management (Countdown Downunder Technotes 2000; Moran 2006). The risk of mastitis in dairy cattle around calving is very high and the successful deployment of calving pads within the dairy industry suggests that the adverse biosecurity aspects of soft floor bedding can be successfully limited with appropriate management. Organic materials such as sawdust and chopped straw were found to have significantly higher moisture contents, faecal-origin bacteria count (including E coli) than inorganic material such as sand and crushed limestone (Hogan et al. 1989). Therefore while the risk of disease spread from inorganic materials is lower than that with organic materials with suitable management, the disease risk from organic floor options can be minimised by good management.

Dirt on livestock

The dirt on livestock resulting from soft flooring is generally superficial and easily removed by standard pre-slaughter washing (Bruce Knee, pers. comm.). Such dirt should not be confused with feedlot dags, an industry problem on the slaughter floor.

There is evidence to show that regardless of the dirtiness of cattle presented for sale and provided 'normal' washing and slaughter procedures are observed, there is no increase in the microbial counts on carcasses (Bruce Knee, pers. comm.). (This also relates to meat quality.)

Survival of bacteria in saleyards

The risk of disease will decrease when the number of pathogens present in the environment is reduced, exposure routes for infection are controlled and/or the resistance of the host animal to infection can be maintained. The physical removal of contamination (e.g. hosing dung from concrete yards) and increasing the exposure of surface pathogens to sunlight and drying (as provided by concrete yards) will reduce the pathogen loads and therefore risk of infection for cattle. Regular maintenance of soft floor yards (removal of dung, replenishment of surface material), whilst not as effective a method of gross decontamination as provided by hosing of concrete yards, will reduce the pathogen load within the yard. A well maintained soft floor yard does not encourage cattle to eat or drink from the floor (thereby reducing risk of infection by the oral route), minimises the risk of penetrating wounds to the skin (thereby reducing the risk of infection of wounds) and may reduce stress within yarded cattle (thereby increasing their natural resistance to infection). The key to managing biosecurity risk is implementation of a program of regular decontamination and maintenance for all yard surfaces.

Many studies have demonstrated that the survival of pathogens tends to be longer in organic-derived bedding (such as straw) compared to inorganic bedding (such as sand) (Small, Reid &

Buncic 2003). Research showed that increased bedding contamination resulted in increased coat contamination of cattle (Hogan & Smith 1997; Hogan et al. 1989). Therefore it is likely that greater coat contamination will occur in cattle marketed through sale yards that use organic-derived soft floors than from yards with hard flooring or inorganic soft flooring such as sand or rubber matting.

Pathogen levels within bedding vary across seasons. The total coliform bacteria count from feedlot pens was found to be positively correlated with air temperature (Miller et al. 2003). This suggests that the removal of faeces and the decontamination of soft floor pens may need to be intensified during summer months to prevent excessive gut-derived pathogen build up within the floor material.

The dairy industry recommends that larger particle size material be used preferentially within calving pads as the microbial load increases within the material proportionately to surface area. For this reason, sawdust is not recommended as a calving pad material for dairy cows unless it can be stored dry before use – a store of wet (unused) sawdust will develop a high bacterial load and this will cancel any advantage from replenishing the surface of yards with fresh material (Countdown Downunder Technotes, 2000). Drainage methods that are recommended for calving pads include the provision of adequate slope (3-4%) and/or the use of slotted PVC drainage pipes under the floor. Removal and replacement of the surface layer will reduce pathogen load within the material. Daily replenishment is much more effective at pathogen removal than weekly replenishment; however weekly removal and replenishment in busy saleyards should reduce infection risk for yarded animals to a satisfactory level because their exposure to the surface is not prolonged (i.e. duration of the sale).

It is essential that the most common routes of infection (i.e. oral, inhalation and wounds) are managed by ensuring troughs remain free of faecal contamination, water does not pool on the floor surface to encouraging drinking from the floor, dust is managed by dampening the yard surface when required and surface are prevented from becoming waterlogged. The build-up of pathogens within calving pad bedding is considered excessive when there are more than one to two pats of manure present per square metre and water can be seen within footprints or surface depressions. The suggestion is that if you have to watch where you put each step as you walk through the pad then the surface needs restoring. These guidelines can be applied directly to saleyard floors.

Foot-and-mouth disease (FMD) virus is able to survive for many weeks in the environment and this may be increased within substrates such as sand, earth and organic materials such as faeces and bedding (AUSVETPLAN Ed. 2.0 Operations Procedures Manual - Decontamination 1996).

AHA's *Guidelines for Managing BJD in Saleyards* states that hosing can remove the vast majority of faeces (and therefore Bovine Johne's Disease and the causative bacteria *M. avium* subsp. *paratuberculosis*) from a hard surface. Drying and exposure to sunlight should reduce contamination further. The survival of *M paratuberculosis* can also be reduced by lime; so concrete surfaces may have a similar effect.

AHA contends that once a shaded, soft-floor saleyard is contaminated, bacteria are likely to survive for considerable periods compared to an outside pen that can be hosed out and is exposed to the sun. (It is worth noting that, although contamination is likely to be higher in cattle barns housing infected cows in Europe and North America than in Australia, calves in such environments are easily infected.) However, the complete removal of all *M. avium* subsp. *Paratuberculosis* from surfaces

contaminated with infected faeces by hosing and exposure to sunlight between sales is unlikely but significant build up of bacteria is prevented by the gross removal of dung provided by hosing.

Soft floor yards must also prevent contamination levels from rising by regular maintenance. This must be managed in conjunction with processes to control the oral route of infection (i.e. preventing eating and drinking from the floor or from faecal contaminated surfaces). A study demonstrated survival of the bacteria in dung pats for up to 55 weeks within shaded environments and for a much shorter period (but in excess of one week) within an unshaded environment irrespective of moisture content (Whittington et al. 2004). Survival of the agent within water was prolonged, extending up to 48 weeks in shaded environments and to 36 weeks in exposed environments (Whittington, Marsh & Reddacliff 2005). These findings suggest that exposure of cattle in saleyards to the bacterial agent of Johne's disease does occur irrespective of floor composition but the hosing of gross waste material from well-drained concrete yard has been very effective at controlling pen contamination levels with the Johne's disease bacteria.

The increased build up of faecal matter within saleyards (as may occur with soft floor materials) may result in increased exposure and therefore measures to remove excess contamination of surfaces in southern saleyards will be required to prevent escalation of the saleyard risk for spread of Johne's disease. Risk of Johne's disease infection on soft floor yards can be managed. The majority of dairy replacement calves are reared communally within soft floor pens. Young calves are at greatest risk of infection with Johne's disease but regular maintenance of the calf pen surface and feeding system reduces the risk of transmission of infection between calves. Similar principles should be applied to the management of pens in saleyards with soft floors. The surface layer should be removed and replenished with fresh material when faecal contamination becomes excessive (i.e. more than one to two faecal pats per square metre).

Although shading would further the survival of *M paratuberculosis*, ammonia from urine and heat generated by the decay of organic material on the floor may help kill it and reduce contamination (Animal Health Australia, 2005).

The use of soft floor materials, sawdust and woodchips, has undoubtedly increased the amount of mud in selling pens since they have been introduced as a cover for concrete flooring. Hosing, which can remove the vast majority of faeces (and therefore the bacteria *M paratuberculosis)* is easier to do on a hard floor. If the roof keeps the floor relatively dry, without being dusty, the bacteria may not be as easily transmitted as on a wet and boggy surface (Animal Health Australia) as wet flooring may increase the risk of transmission of the bacteria that cause digital dermatitis or other infectious hoof diseases which cause lameness (Rushen et al, 2004).

The gut-derived food borne pathogens include *E. coli* O157, *Campylobacter jejuni* and *salmonella* spp. These organisms do not produce disease in the animals (except for occasional disease events due to salmonella) but can cause food poisoning or food infection in humans from consumption of contaminated meat products. Studies have demonstrated that transmission of enteric food borne pathogens between cattle can occur at saleyards and abattoirs. A study of abattoir lairages found that *E. coli* O157, salmonella and *Camplylobacter jejuni* within faeces survived between batches (one day to the next) irrespective of the floor composition (Small, Reid & Buncic 2003). This was confirmed in the study of Collis et al. who mapped the contamination pathway within saleyards and abattoirs by inoculating the coats of a small number of cattle with gut-derived food borne pathogens (Collis et al. 2004). This resulted in extensive transfer of pathogens to the yard environment and to the skin of other cattle. These findings imply that saleyards with hard flooring do result in the exposure of cattle to various pathogens excreted from cattle yarded on a previous day but the

presence of organic soft flooring may allow increased levels and therefore exposure of cattle to these pathogens.

A study of feedlot cattle demonstrated that a higher prevalence of cattle from muddy pens shed *E. coli* O157 than for cattle from dry pens (Smith et al. 2001). Therefore the control of surface moisture may minimise risk. The significance of soft flooring within saleyards as a pathway of transmission for food-borne pathogens is incompletely defined. For example, a study of US feedlots found faecal sample(s) from 87% of pens to be positive for *E coli* O157 (with a within-pen prevalence of 3-78%) (Dewell et al. 2005). Similarly, a study of Ohio dairy cows sent for slaughter found *Campylobacter jejuni* (7% samples), *Salmonella* spp. (6.7% samples) and *E. coli* O157 (2.1% samples) within faeces from dairy cows. The increase to the current risk that soft flooring within saleyards will provide is undefined. However, appropriate floor construction, (especially pen drainage), regular maintenance and decontamination between sales and appropriate animal marketing and movement within the saleyard will minimise the risks of excessive transfer of pathogens to yarded animals.

The disposal of contaminated bedding and flooring can be problematic. Most saleyards are located near to residential towns and the on-site burial or incineration of material may not be possible. The AUSVET disposals manual suggests that contaminated material that needs to be transported for disposal be done so in sturdy leak-proof and covered (preferably with polyethylene) containers (AUSVETPLAN Ed. 2.0 Operations Procedures Manual - Disposal 1996). An alternative option for less contagious agents is to compost bedding material within mounds that cannot be accessed by animals. Composting waste heaps of manure and bedding material (eg straw) resulted in heap core temperatures exceeding 50° C and a ten-fold reduction in pathogen levels within three days. Heaping promotes composting and this generates the heat that kills bacteria (Hutchison et al. 2005). The method used to dispose of used floor material must be carefully considered. This material is often in demand as garden mulch. A composting process is recommended if waste floor material is to be used as garden mulch.

No documented evidence was found to suggest that there is an increased disease risk associated with muddy selling pens in Australia given our current disease status. Although not documented, this does not mean that the risk is not greater. The use of soft floors within intensification sites in cattle production systems already exist, although not widely in saleyards where the mixing of stock and their subsequent redistribution is not the same. The additional risk that saleyard flooring may provide is not well understood.

A case could be made to suggest there is an increased possibility of disease transference because some pens cannot or may not be cleaned between sales. But is the risk any greater than under the previous situation where the cattle are housed in ‘clean’ concrete pens prior to sale? In winter these pens can be awash with faeces and urine, as are the laneways and holding pens. There has been no work done to compare the risks.

In addition, nothing changes with respect to transport, where even though the animals are relatively empty, considerable amounts of urine and faeces are excreted during transport.

Transfer of diseases

There are four major ways that infection can transmit between animals. These are by: ingestion (oral), inhalation (respiratory), skin wound contact (eg puncture wound) and by sexual transmission (via the reproductive tract). The composition of the floor in a saleyard may influence the oral, inhalation and skin wound methods of infection.

The presence of a pathogen within a facility does not guarantee the transmission of the agent (resulting in disease) between animals that use the facility. Exposure does not equate to transmission of the pathogen.
While it is likely that the use of soft floor bedding may increase the exposure of cattle to oral transmission pathogens, the prevention of ingestion of contaminated flooring (i.e. eating and drinking of contaminated feed/water or from contaminated troughs or directly from the floor) by yarded cattle is likely to be effective at minimising transmission of these agents between animals (including Johne's disease). Well designed and maintained soft floor saleyards and suitable stock holding and pen movement policies within the saleyard will minimise the risk of spread of disease between cattle and across sale days in yards that use soft floors.

Similarly, reducing the amount of airborne fine particulate matter arising from the floor material will reduce irritation to the lower airways of yarded cattle. Excessive inhalation of fine particulate matter results in reduced resistance of the lower respiratory tract to infection by respiratory pathogens (MacVean, Franzen & Keef 1986). Procedures such as surface wetting (of dry and dusty surfaces) before yard use will be required. The preferential use of coarser floor material is recommended.

The increased pathogen load within organic bedding may result in increased risk of infection following traumas such as foot sole penetration or skin wounds. Invasion of wounds by bacteria such as *A. pyogenes* and obligate anaerobes such as *Fusobacterium* spp. and *Bacteroides* spp. may be increased within organic soft bedding material. The production of anaerobic conditions within bedding by waterlogging promotes proliferation of these bacteria and contributes to maceration of the skin resulting in increased ease of penetration. F. necrophourm is a natural gut inhabitant and therefore a build-up of faecal material within pens will result in increased external exposure to this bacteria (Nagaraja et al. 2005). The removal of waste material and replenishment of the surface when faecal contamination is excessive (i.e. more than one to two pats of manure every square metre) is necessary to reduce the load of these bacteria and the risk of traumatic infection in livestock during periods of continual use.

The impact of various floor surfaces on biosecurity for a range of pathogens and scenarios is summarized in Tables 2, 3, 4 and 5.

Table 2 Flooring types and their potential to harbour pathogens

	Pathogen					
Flooring type	Johne's disease	E. coli	BRD viruses[1]	Leptospirosis.	F. necroph.	FMD virus
Woodchip	** (dry) *** (wet)	** (dry) *** (wet)	*	* (dry) ** (wet)	* (dry) *** (wet)	***
Woodchip / sawdust	** (dry) *** (wet)	** (dry) *** (wet)	*	* (dry) *** (wet)	* (dry) *** (wet)	***
Sawdust	** (dry) *** (wet)	** (dry) ***(wet)	*	* (dry) *** (wet)	* (dry) *** (wet)	***
Rubber matting	* (dry) ** (wet)	* (dry) * (wet)	*	* (dry) * (wet)	* (dry) * (wet)	*
Sand	** (dry) *** (wet)	* (dry) ** (wet)	*	* (dry) ** (wet)	* (dry) *** (wet)	**
Earth / gravel	** (dry) *** (wet)	* (dry) ** (wet)	*	* (dry) ** (wet)	* (dry) *** (wet)	**
Concrete	* (dry) ** (wet)	* (dry) * (wet)	*	* (dry) * (wet)	* (dry) * (wet)	*

N.B. The number of stars denotes the capacity of a floor type to harbour bacteria, i.e. potentially more detrimental to biosecurity, with *** denoting highest capacity to harbour bacteria.
(Dry) or (Wet) describes if the floor is wet or dry.
1. The spread of respiratory pathogens involved in the Bovine Respiratory Disease (BRD) complex is predominately via the inhalation of infected droplets (fomites) that have been exhaled by other infected cattle, as most agents do not live for substantial time outside the host.

Table 3 Flooring types and their ease of transmission of pathogens by route of infection

	Transmission pathway		
Flooring type	Oral	Respiratory	Skin / wounds
Woodchip	** (dry) *** (wet)	Not of concern	* (dry) *** (wet)
Woodchip / sawdust	** (dry) *** (wet)	Dust predisposes	* (dry) *** (wet)
Sawdust	** (dry) *** (wet)	Dust predisposes	* (dry) *** (wet)
Rubber matting	* (dry) * (wet)	Not of concern	* (dry) ** (wet)
Sand	** (dry) ** (wet)	Not of concern	* (dry) *** (wet)
Earth / gravel	** (dry) *** (wet)	Dust predisposes	* (dry) *** (wet)
Concrete	* (dry) * (wet)	Not of concern	* (dry) *** (wet)

N.B. The number of stars denotes the capacity of a floor type to transmit infection, i.e. represents a higher biosecurity risk, with *** denoting highest capacity to transmit infection or greatest biosecurity risk.
(Dry) or (Wet) describes if the floor is wet or dry.

Table 4 Flooring types and ease of decontamination and disinfection

	Pathogen					
Flooring type	Johne's disease	E. coli	BRD viruses	Leptospirosis	F. necrophorum	FMD virus
Woodchip	*** (dry) *** (wet)	** (dry) *** (wet)	Not of concern	** (dry) *** (wet)	** (dry) *** (wet)	*** (dry) *** (wet)
Woodchip / sawdust	*** (dry) *** (wet)	** (dry) *** (wet)	Not of concern	** (dry) *** (wet)	** (dry) *** (wet)	*** (dry) *** (wet)
Sawdust	*** (dry) *** (wet)	** (dry) *** (wet)	Not of concern	** (dry) *** (wet)	** (dry) *** (wet)	*** (dry) *** (wet)
Rubber matting	** (dry) *** (wet)	* (dry) * (wet)	Not of concern	* (dry) ** (wet)	* (dry) ** (wet)	** (dry) ** (wet)
Sand	*** (dry) *** (wet)	*(dry) ** (wet)	Not of concern	*** (dry) *** (wet)	** (dry) *** (wet)	*** (dry) *** (wet)
Earth / gravel	*** (dry) *** (wet)	*** (dry) **(wet)	Not of concern	*** (dry) *** (wet)	** (dry) *** (wet)	*** (dry) *** (wet)
Concrete	** (dry) *** (wet)	*(dry) * (wet)	Not of concern	* (dry) ** (wet)	* (dry) ** (wet)	** (dry) ** (wet)

N.B. The number of stars denotes the capacity of a floor type to be disinfected i.e. represents a higher biosecurity risk, with *** denoting most difficult to disinfect or highest biosecurity risk.
(Dry) or (Wet) describes if the floor is wet or dry.

Table 5 Flooring types and ease of pathogen disposal

Flooring type	Pathogen
Woodchip	**
Woodchip / sawdust	***
Sawdust	***
Rubber matting	*
Sand	**
Earth / gravel	***
Concrete	*

N.B. The number of stars denotes the capacity to dispose of floor pathogens i.e. represents a higher biosecurity risk, with *** denoting most difficult to dispose of pathogens or highest biosecurity risk.

The survey results have shown that saleyard managers believe there is some increased biosecurity risk but it is far outweighed by the benefits of soft flooring. An improvement to animal welfare (and to the quality of marketed cattle) from the use of well-designed soft flooring within saleyards is likely. The increased risk of disease spread that may arise from use of soft floor materials can be managed and controlled through use of well designed, maintained and managed soft flooring saleyards. Soft floor should ideally be covered, constructed on a suitable base that provides an even surface, incorporate sufficient drainage to prevent waterlogging, include troughs that are high enough to facilitate cleaning and prevent faecal contamination and have adequate access for maintenance (i.e. machinery access). The floors require a program of maintenance that includes (ideally) dampening when dry and dusty before use, replacement when waterlogged, removal of gross faecal contamination and replenishment of the surface layer. The maintenance routine may need to be as frequent as weekly under heavy use and adverse environmental conditions. The most suitable guideline for maintenance is to restore the surfaces when they are waterlogged or when there are more than one to two faecal pats per square metre in the pen. Pen management within the saleyard should be such that at risk stock are not exposed to contaminated yards (e.g. placing calves within pens that have faecal contamination from adults).

A well designed soft flooring system would be approved by a civil engineer, have a minimum 200 mm gravel subsurface, the soft floor of an approved thickness and be harrowed or aerated after each sale or as required. A topping up of the soft floor and replacement policy should be developed for each site based on manure content and moisture levels.

4.1.2 AUSVETPLAN

The *Enterprise Manual for Saleyards and Transport*, a specialised part of the Australian Veterinary Emergency Plan, *AUSVETPLAN* (Edition 2.0), sets out various requirements for saleyards in the event of an outbreak of an emergency disease (Enterprise Manual, Saleyards and Transport, 1999).

This document should be mandatory reading for any saleyard operator, and anyone contemplating soft flooring should ensure their new floor complies with the AUSVETPLAN requirements.

The AUSVETPLAN suggests that there is considerable opportunity for the spread of disease within and from saleyards and that the primary infectious outputs will be livestock and their excretions such as manure and urine.

One of three basic tools listed for disease control is the *"disinfection of contaminated areas and things".* The disinfection of bedding and flooring is impractical and ineffective because bacteria can hide from the agent within any organic material that may be present. Therefore the disinfection of concrete or rubber (after thorough hosing) will be much more effective than disinfection of particulate soft floor surfaces that cannot be hosed. This will be irrespective of the type of disinfection used and for all pathogens. A program of surface replenishment and removal of excessive faecal contamination will be more effective at controlling pathogen levels within particulate soft floor yards than occasional disinfection using chemicals. The most effective disinfection process is surface replenishment. The use of disinfection within pens is recommended when particulate soft floors are totally replaced and the pens can be thoroughly decontaminated (eg hosed clean) before laying the new floor.

A study of dairy cow bedding suggested that twice daily application of lime may be necessary to sustainably lower bacterial levels within bedding because a single application of lime reduced bacterial counts for only one day in treated manure and was not effective when applied to sawdust bedding. A key component of effective disinfection is the thorough removal of organic material and the cleaning of surfaces before application of the chemical (Kahrs 2005) This is not possible when soft floor bedding materials such as sawdust, woodchips and sand are used.

The disposal of used particulate soft floor material can be a problem. The bulk of the material and presence of pathogens requires careful disposal. The use of material as landfill or the reduction of pathogens by composting are suggestions for safe disposal. The particulate floors are especially problematic if an exotic disease is suspected within a facility. For example, foot-and-mouth (FMD) virus is able to survive for many weeks in the environment and this may be increased within substrates such as sand, earth and organic materials including faeces and bedding (*AUSVETPLAN Ed. 2.0 Operations Procedures Manual - Decontamination* 1996). The disposal of contaminated particulate matter bedding and flooring can therefore be very problematic when exotic disease outbreaks are suspected. Most saleyards are located near to residential towns and the on-site burial or incineration of material may not be possible. The AUSVET disposals manual suggests that contaminated material that needs to be transported for disposal be done so in sturdy leak-proof and covered (preferably with polyethylene) containers (*AUSVETPLAN Ed. 2.0 Operations Procedures Manual - Disposal* 1996).

An alternative option for less contagious agents is to compost bedding material within mounds that cannot be accessed by animals. Composting waste heaps of manure and bedding material (eg straw) resulted in heap core temperatures exceeding 50° C and a ten-fold reduction in pathogen levels within three days (Hutchison et al. 2005).

4.2 Cleanliness, saturation and odour

Concrete flooring needs vast quantities of water to clean compared to soft flooring options (such as woodchips which absorb waste), resulting in better effluent management. The rate of replenishment and cleanout frequency for each saleyard surveyed is a matter of usage, rainfall and evaporation rate combined with experience and site characteristics. Clearly the more often yards are cleaned out the better and it appears that only rubber matting and concrete give an easy option of washing down and removing and collecting the water and any pathogens. Slippage, mud levels, and preparation for wet conditions over winter will determine frequency of cleaning.

It is important that the soft floor material is kept below a certain moisture level to allow oxygen to be present in the floor and remain an aerobic environment. If the yards are open to the weather, the benefits are likely to be minor if wet weather persists and the saturated bedding remains wet for extended periods, particularly in winter due to mud, odour and slippage of cattle and handlers. Mud reduces cow mobility and increases the labour required to move cows, and saturation reduces hoof hardness and increases susceptibility to wear and damage (Rushen et al, 2004). As stated in section 4.1 “Animal health and welfare – including biosecurity”, cattle must have dry flooring for standing in order to control the incidence of lameness.

There is plenty of overseas evidence to show that bedding materials reduce odour emissions in covered pens, so long as the absorptive capacity of the bedding material is not exceeded, according to the Mid West Planning Service (1993).

URS Australia was commissioned on behalf of the City of Ballarat to undertake an assessment of odours at the Bairnsdale Saleyard (Vic) in order to demonstrate compliance with the State Environmental Planning Policy’s (Air Quality Management). It was concluded that dust emissions would not adversely impact the environment. Other data was too limited to provide sufficient information on the potential variation in odour emission rates from saleyards (Bowley, S. 2006).

There is no Australian data on the likely volumetric requirements for the bedding material needed to absorb moisture from the urine and faeces voided by cattle housed within buildings. However, in North America the Mid West Planning Service does provide such recommendations (Livestock Waste Facilities Handbook, 1993). These are shown in Table 6, along with the water absorption capacity and the typical bulk density of these materials (Potts and Casey, 1999).

Table 6 Bulk density, water absorption capacity and typical requirements for various types of bedding material (MWPS, 1993)

Bedding material	Bulk density	Water absorption	Requirements
Sawdust	225 kg/m³	2.5 kg/kg	4.1 kg/d/t LWT
Shavings	150 kg/m³	2.0 kg/kg	3.1 kg/d/t LWT
Straw	40 kg/m³	2.2 kg/kg	11 kg/d/t LWT
Hay	64 kg/m³	3.0 kg/kg	9.3 kg/d/t LWT

4.3 Meat quality

Reducing animal stress is critical to the market requirements for producers, meat processors, retailers and consumers. It is well documented that stress can be a primary cause of reduced meat quality.

During the change of livestock ownership process, the level of stress should be curtailed as much as possible. Fear responses can cause higher than normal levels of adrenalin and cortisol, adversely affecting the levels of glycogen in muscle tissue. This in turn can reduce the eating quality of beef through increased toughness, a darkening of the meat colour, shorter shelf life and lower saleability of the product.

In late 1999, experiments were conducted through the Camperdown and Wodonga saleyards to determine the penalty that should be applied to slaughter stock destined for grading under the Meat Standards Australia (MSA) guaranteed meat eating quality program.

It was commonly anticipated by many in the industry that the penalties for livestock sold through saleyards would be very high, making it virtually impossible to grade their meat under the MSA system.

The results of these experiments are contained in the report “Benchmarking of Beef Quality from Victorian Saleyards”, published by Food Science Australia in July 2000.

An important part of the experimental protocol was to sell the experimental animals using what was considered to be ‘best practice’. The two crucial practices implemented were for the cattle to be held on soft standing as much as possible given the selling facilities and ‘no mixing’ of stock from different properties. At the time, all major selling facilities had only concrete selling pens.

The experiment minimised the period on concrete both before and after sale and this practice was believed to be a major contributor to the low penalty of 3 to 5 MSA points deducted for stock sold through saleyards.

While soft flooring is a preferred option for a saleyard seeking MSA accreditation, to this point in time it is not a mandatory requirement (Toohey, 2005).

4.4 Feedlot stress

It is vital for a feedlotter to receive cattle in as healthy a condition as possible so the animals can make a rapid transition from a pasture based diet to a grain based diet. The introduction into a feedlot environment is stressful to cattle, although there is a commercial vaccine available for respiratory disease. Young cattle, particularly weaners, are susceptible to a number of adverse conditions if they are placed under too much stress. It is a novel environment where cattle are mixed and have to interact with new pen mates and develop a new dominance hierarchy in a high-density environment. Cattle can take up to two weeks to establish a new hierarchy and will not be settled until this occurs.

If the animals arrive in an already stressed condition, the additional stress of a changed diet and the development of a new dominance order can be enough to compromise their immune system and allow sickness to develop.

It is critical to get feed into the cattle as soon after arrival as possible to avoid conditions such as 'dead belly' where rumen fermentation is restricted.

Lameness restricts the ability and the desire of the animal to seek food. Lame cattle often sulk in corners trying to avoid contact or lie down for extended periods, further compromising their ability to adapt and increasing the risk of disease and nutritional upsets.

4.5 Occupational Health and Safety

Overall, there is an improvement in OH&S standards in using soft flooring because there is no longer a hard surface putting strain on legs- both animal and human. The life left in human legs after a day in soft standing yards compared to concrete yards is a very important factor.

There is however a possible OH&S issue associated with the use of rubber matting. Several survey respondents have indicated some types of rubber matting can become very slippery for both man and beast, making it a potentially dangerous work environment. Slippery flooring has been responsible for injuries to cattle, including bruising, broken legs, hip damage and dislocated hips.

Saleyard owners must use common sense. Obviously a saleyard can become a danger zone even with the right soft flooring material if the saleyard has no roof, walls, a lot of rainfall and no regular maintenance or cleaning. The result is ponding, mud, a place for bacteria to thrive, dirty cattle, and a build up of manure. The depth of mud in saleyards can make cattle handling more dangerous. The handlers' ability to evade cattle is impeded the deeper the mud becomes, so the likelihood of injury in situations where mud has been allowed to build up increases as the depth increases.

(Refer to section 8 - "Decision Support Tool")

4.6 Saleyard design

New Greenfield yards are designed for easy access to all pens to clean and replace soft floor material. This creates the opportunity to easily provide maintenance of the material to assist in aeration and reduction of moisture levels, which in turn reduce odour and the risk of disease transfer. Well-designed access also allows for the opportunity to have clear delineation between cattle and people for improved safety. This is a specialised area, combining all the objectives within defined parameters - including a budget.

Yards that are to be renovated have generally poor access for cleaning. Footings for a roof are a challenge in these yards as existing post columns are unsuitable and so the yard requires new columns.

4.7 Cattle pen density

Prior to all sales a "draw" is conducted to allocate pens to agents for the cattle. Insufficient or poor allocation of pen space can have a major affect on lameness if cattle are unable to lie down to rest. Research conducted by Peter Best (outlined in section 4.1 – "Animal Health and Welfare – Including Biosecurity") shows that dairy cattle require at least 14 hours resting time in free stall barns. In the transporters survey report (see section 5.4 – "Transporters Survey Results") the consensus was that tired cattle with sore feet do not travel well, particularly over long distances.

The model code of practice for the transport of cattle (2002) states that cattle should be fed, watered and rested for at least 12 hours in a loading facility if mustering has caused considerable physical exertion. Stocking densities appropriate to the species and the number and nature of animals involved, should not be exceeded. As a guide, 2.25 m^2 per beast is recommended for adult cattle in selling pens, and 2.7 m^2 in holding pens to allow easy movement and resting. Lower densities should be used where there are calves at foot. (Model Code of Practice for the Welfare of Animals, Animals at Saleyards, SCARM Report 31).

In Version 2 of Australian Standards for the Export of Cattle, a minimum pen area per head for cattle exported by sea has been developed with a range of contingencies. These include the time of year, whether cattle are pregnant, duration of voyage, and most importantly the weight of the cattle.

As a guide only the following minimum pen area per head for cattle exported by sea are:

Liveweight (kg)	Minimum pen area (m^2/head)
200	0.770
250	0.940
300	1.110
350	1.280
400	1.450
450	1.620
500	1.790
550	1.960
600	2.130

Source: Australian Standards for the Export of Livestock, Version 2, September 2006.

(Please see Appendix 5 for the full table: “Minimum pen area per head for cattle exported by sea”.)

The above space allowances have been used by Atlex Stockyards in designing saleyards and conventional farm cattleyards since 1997 as a guide to comfortable capacity. The saleyard industry should formulate a minimum standard to address the density of pens, whether for soft floor or hard surface to allow cattle to rest and not be tired during transport. This will have a positive affect in reducing lameness.

The lack of detail in the Code of Practice for saleyards highlights the need for the saleyard industry to explore more comprehensive stocking densities more in line with the Version 2 of Australian Standards for the Export of Cattle.

5 Survey results

5.1 Cattle buyer survey results

Sixteen cattle buyers who replied (out of 20) and who buy for feedlots, processors, backgrounders, graziers and saleyards in the Australian southern beef zone responded to a survey created for the purpose of this review. (See Appendix 1.) The average number of cattle bought annually by these sixteen respondents was 12,510 per head and in a range from

520-51,500 per head. The southern beef zone in this report refers to New South Wales, Victoria, South Australia and south of Geraldton in Western Australia.

5.1.1 Lameness

The survey asked if the respondents had noticed lameness in cattle in hard-floor saleyards**,** whether the respondents had purchased any cattle showing signs of lameness, whether the lameness could be associated with specific yards, and if there were any classes of cattle more susceptible to lameness in the yards in question. It also asked if the seasons had an effect.

The results showed:

- 62.5% had purchased cattle showing signs of lameness.
- Of these 75% had negative consequences (i.e. death or severe setback).
- The lameness was only reported in some yards in the lower Victorian Western District where annual rainfall exceeds 800mm.
- Weaner and heavy cattle (e.g. old cows) and particularly European breeds were the worst affected.
- Opinion was split on whether the problem was worse at different times of the year, but of those who thought it was a problem related to the time of the year, most felt it occurred during the warmer months.

The survey questioned respondents on whether they would prefer to buy cattle from saleyards offering soft standing.

Soft standing was a serious issue in their business for 50% of respondents, and another 40% considered it was an issue ‘sometimes’.

A majority - 75% - said they would prefer to buy cattle from a saleyard offering soft standing.

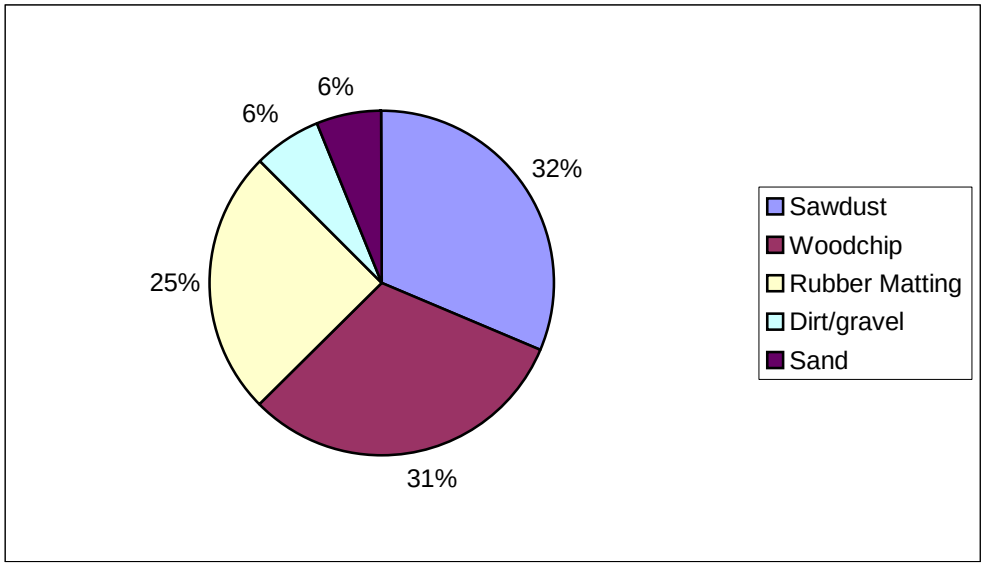
While more than half these buyers seek to purchase cattle from soft-floored yards, other considerations were quoted as just as important such as stock temperament, distance and the availability of suitable quality stock.

5.1.2 Preferred surface

The survey asked if the respondents had a saleyard flooring preference and, if so, why.

The preferred results for the sixteen respondents are sawdust and woodchip - shown below in Figure 2.

Figure 2 Buyer preference for saleyard flooring



The following comments were included in the survey responses:

- Sawdust seems to work well, but unless it is thick the concrete comes through.
- Woodchips have less dust, but are mushy and smell when wet.
- Rubber is less susceptible to disease on the surface, is cleaner and works well but is slippery.

(Other comments indicated limited experience with the range of flooring types.)

5.1.3 Respiratory disease

The survey asked whether respiratory disease was considered a problem in soft-floored saleyards.

It was not considered a problem by 62.5% of respondents.

31.25% considered it was a problem, and 6.25% were not sure.

Bovine Johne's Disease (BJD) was not mentioned by any respondent. This disease occurs in cattle in south-eastern Australia. Breeding cattle are the main carriers of Johne's disease and risk management should be tightened for any breeder sales that are held at a selling centre (Animal Health Australia).

The presence of BJD (*M. avium* subsp. *Paratuberculosis)* should be assumed within saleyards in south-eastern Australia as studies have demonstrated great capacity of the bacteria to survive within the environment. Current understanding of the infection process is that young cattle (less than 12 months of age) are at increased risk of infection following ingestion of the agent and that older animals may be more resistant. The prevalence of infection is highest within the dairy industry and the prevalence of clinical disease (and shedding) increases with increasing age of cattle. Therefore, care should be taken to prevent the contact (direct or indirect) at saleyards

between adult cattle and young cattle that are not destined for immediate slaughter. This is irrespective of the type of flooring used by the saleyard. Saleyards should reduce contamination level by the regular removal of faecal material from pens and reduce risk of exposure by preventing faecal contamination of troughs and discouraging stock from eating or drinking directly from the floor and by managing which stock classes use certain pens (i.e. prevent calves from using the same pen as used by adult cattle —especially dairy cows — during the course of a sale). These processes will minimise any increase in risk of transmission of BJD that may arise from the use of particulate soft floors within saleyard pens.

The spread of respiratory pathogens involved in the Bovine Respiratory Disease (BRD) complex is predominately via the inhalation of infected droplets (fomites) that have been exhaled by other infected cattle, as most agents do not live for substantial time outside the host. These agents include viruses such as parainfluenza 3, bovine respiratory synciitial virus and bovine herpesvirus 1 and complicated by bacteria such as *mannheimia haemoltytica.* A major defence mechanism of the lower respiratory tract of cattle is the mucociliary transport mechanism. This involves the trapping of inhaled fine particles within surface mucous which is subsequently removed from the lower tract by cilial transport. This mechanism can be swamped when excessive amounts of fine particulate matter are inhaled (i.e. fine dust) and this can predispose to establishment of infection. Any increase in dust due to soft flooring may promote the transmission of respiratory pathogens between yarded cattle.

5.1.4 Other problems

62.5% of buyer respondents considered there to be other problems with soft flooring.

Major points were:

- Without a roof, soft flooring will not work. There is a need to replace wood based products frequently if there is no roof.
- Cattle are not comfortable if wet underfoot for long periods.
- Dust can be a problem with some forms of soft flooring such as woodchip and sand.
- Rubber matting does not have sufficient longevity.
- A gravel base under soft flooring with sharp stones induces lameness.

Other points raised:

- It's a political football, but not as big a problem as welfare groups suggest.
- Wet periods are the hardest to overcome as it is difficult to find suitable material if yards are not roofed.
- Soft flooring has enormous benefits for vendors and buyers of weaner and heavy slaughter cattle.
- Is there a generic problem in modern cattle?
- There are many other issues to consider such as loading and unloading but most important is the temperament of the cattle.
- Problems only occur with cattle going to feedlots or back to the paddock. There are very few problems with slaughter cattle.

5.2 Saleyard owner/manager survey results

Sixty-six survey forms were emailed out to all owners/managers of cattle saleyards in Australia's southern beef zone. (Again, see Appendix 3.) Twenty replied and two others responded too late for inclusion. Four of the 20 that answered use concrete, and sixteen use various soft flooring.

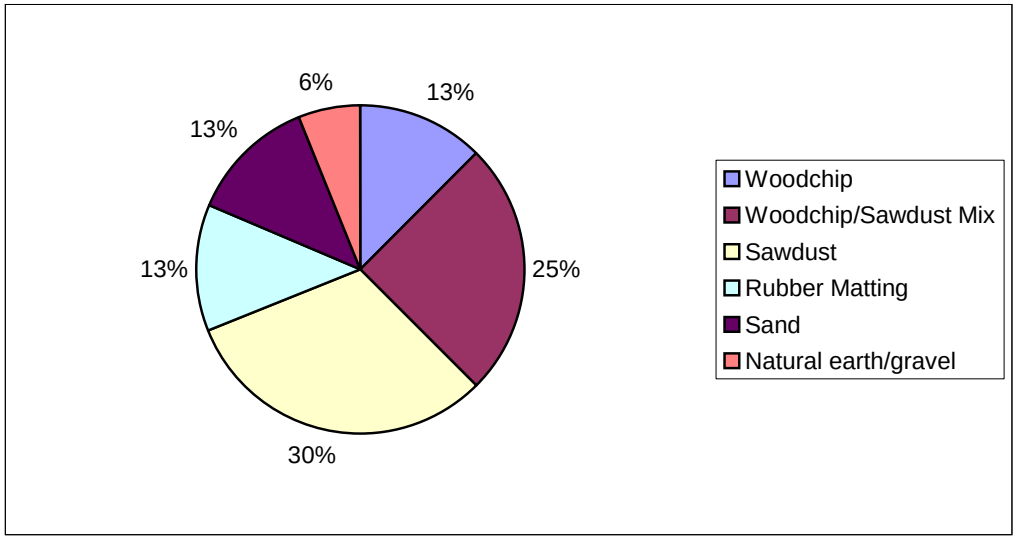
Respondents were from New South Wales, Victoria, South Australia and Western Australia.

The average throughput of the respondents' saleyards was 52,142 head per annum, with a range from 6,400 to 140,000 head per saleyard.

5.2.1 Soft standing materials in use

Saleyard owners/managers were asked to describe the type of soft standing material used at their saleyard. Woodchip and a woodchip/sawdust mix were preferred – as shown below in Figure 3.

Figure 3 Saleyard owners/managers description of soft flooring in their saleyard



5.2.2 Date of installation of soft floors

The range of time frames for installations ranged from 1990-2005 from the 17 saleyards which had introduced soft floor.

4 in 2005	2 in 2000
3 in 2004	2 in 1997
2 in 2003	1 in 1995
1 in 2002	1 in 1990
1 in 2001	

5.2.3 Roofing of soft-floored area

Respondents were queried on whether they have a roof and, if so, what type. They were also asked how they protected the edges of the soft floor under the roof from the weather.

The results showed that 50% of respondents' saleyards were roofed or partly roofed and 50% were not. Of the ten who had roofs, 60% had sword tooth, 30% had gable and 10% had a dome style. Generally, the sides of the covered yards are poorly protected from rain. One structure had very poor protection from rain, 20% had concrete on most sides, 20% were partially sheeted on the side of prevailing weather and 10% had shadecloth. There were no yards fully enclosed.

5.2.4 Use of a sub-base

The survey asked whether respondents used a floor sub-base such as 200mm compacted gravel or an existing concrete floor. Results showed that 45% of respondents used a sub-base of concrete under their soft floor material and 45% placed their soft floor material over compacted gravel, crushed rock, crushed limestone, sandstone or existing soil.

10% did not answer the question.

5.2.5 Cleaning procedures

The survey asked the respondents to describe the cleaning or renovating ability of their soft flooring. Results showed that 50% of respondents believed cleaning out soft floor was quite easy, 15% somewhat easy, 15% a little difficult, 5% difficult and 15% did not respond.

Respondents were also asked to describe the cleaning procedures required to keep their soft flooring material in good condition from an animal welfare and environmental viewpoint.

Almost all yards reported using a mechanical skid steer with a bucket attachment to remove excess manure build up or to aerate the surface, with frequency varying from weekly through to once per annum. Some were cleaned on an “as needs basis”. Fifteen percent said they did not clean.

Only one respondent provided information on the cost of cleaning the yards. This cost was 52 cents per square metre to remove manure and surplus hay in a feeding yard with a gravel base twice per year with a front-end loader.

5.2.6 Biosecurity risk

The survey asked whether respondents considered there to be any perceived or actual biosecurity risks involved with the use of their soft flooring. This may involve the potential for disease spread and/or transmission between different groups of animals. The multiple-choice answers were: “no”, “mild risk” and “yes”.

Fifty percent of respondents considered there to be no biosecurity risks involved with their soft flooring.

Another 10% considered there was a high risk, and 10% thought there was only a mild risk.

The other 30% did not answer the question.

5.2.7 Impact of soft flooring on foot soreness

Saleyard owner/manager respondents rated the impact soft flooring had on foot soreness very highly, as follows:

- Very important 14 or 70%
- Important 3 “ 15%
- Of little use 2 “ 10%
- Irrelevant 0 “ 0%

One respondent did not answer the question.

Supporting comments made were consistent with cattle being fresher, moving more freely and traveling well after being held on soft flooring.

A significant comment was that foot soreness was not solely related to concrete floors, but to cattle management, transport time, stress and importantly individual animal temperament.

5.2.8 Impact of soft flooring on labour requirements

The respondents were asked if soft flooring had reduced the labour requirements in yard management.

One saleyard did their redevelopment in two stages three years apart. One section was roofed with a sawdust soft floor and the remainder was an unroofed concrete floor which was hosed weekly. The concrete area required washing out with high-pressure water - using the existing effluent system - whereas the soft floor required a bobcat to rotate the floor weekly to assist in drying and reduction of moisture and odour level.

A similar labour component is required with the use of a bobcat; however the ease of the work is increased due to the mechanical nature of operation of a bobcat compared to the hard manual labour required for hosing.

The survey results showed that 35% of respondents believed there was a 23% reduction in labour, 45% of respondents said there was no reduction, and 20% did not answer the question.

5.2.9 Noise levels

The survey inquired as to what impact soft floors had on the noise level. The options were “quieter”, “no change”, “not as quiet”, or “noisy”.

The survey showed that 15% of respondents believed that the noise level was quieter with soft floor, 55% said it showed no change, and 30% did not respond. No respondents believed soft floor produced more noise.

5.2.10 Impact on Occupational Health and Safety

Respondents could choose between the following multiple-choice answers on the impact of WorkSafe standards for workers in their soft-floor saleyard: “much improved”, “improved”, “no change” or “not as good”.

It was found that 35% of respondents thought OH&S standards for workers had “improved”, 10% stated it was “much improved” and 25% considered there was “no change”. This improvement was based on the more mechanical nature of using a bobcat compared to the very manual hosing down of traditional concrete floor yards.

30% did not answer the question.

5.2.11 Odour

The surveys revealed that any increase in odour by using soft floor was of no real concern to 65% of the respondents. Five percent thought there to be some increase in warmer weather, and 30% did not respond.

5.2.12 Increase of flies

The survey asked whether there were more flies with a soft floor.

No additional fly problems were reported by 80%, 5% thought there may be a build up under rubber, and 15% did not answer.

5.2.13 Water usage

Respondents were queried on whether there has been a saving in water usage by using soft flooring and if so, how much.

Sixty percent of respondents reported a water saving of 61% (average), in a range of between 10% and 100%. The lower percentages were from rubber matting as this surface over concrete still requires washdown. Sawdust type surfaces do not require any washdown except at scales and ramps.

All yards require water for truckwash and cattle troughs.

Thirty-five percent of respondents indicated no water savings and 5% did not answer the question.

Two yards which had introduced soft floor had previously broom-cleaned their concrete yards, thus there was no saving of water in these two yards.

5.2.14 Potential environmental management issues

Respondents were asked to comment on any potential issues for environmental management that their soft flooring has highlighted.

One respondent surveyed had a discharge warning from the Environmental Protection Authority (EPA) with an open saleyard draining all effluent into a single pond near a stream. It was pumped out periodically to reduce the level. A complete redevelopment with a new roof and gravel soft floor regularly cleaned resulted in no effluent runoff under this roof and the surplus rainwater off the roof was directed into the nearby stream.

Another saleyard was adjacent to wetlands with large environmental concerns. The entire facility was redeveloped with a roof, 200mm deep compacted sandstone sub-base and 200mm deep sawdust. All water from the roof was stored in a series of water tanks and recycled for cattle trough water. The sawdust was replaced as required by a bobcat.

5.2.15 Key individual comments

- “Red Gum sawdust breaks down faeces and urine and sheds water owing to its acidic nature. This also prevents odour.”
- “Tried rice hulls - not as good as sawdust.”
- “Long-term fixing of rubber matting may be a problem.”
- “With better control of the time cattle spend on concrete there should be no problem.”

Ideas:

- “Maybe trial a plastic or plastic coated material.”
- “Install under-floor heating pipes, solar heated from on-roof panels, to dry the floor and provide a warm environment for the stock.”

5.3 Vendor survey results

Ten vendors were surveyed (see Appendix 4) at one store cattle sale. The variation included 800 to 20 cow replacement herds, from dedicated backgrounders, to speculative buyers and sellers and a mix of cattle owners in between. Of the vendors surveyed, the average sold 198 head per year; 70% of those surveyed sold less than 100 head. Fifty-seven percent of the cattle sold by the respondents were sold through saleyards.
Of these ten vendors surveyed, 30% said their main income was from beef, and 70% was principally from another source. All vendors considered soft floored saleyards a priority for feature weaner sales and believed that animal welfare was a big issue without specifying what the issues were. Seventy percent believed more should be done to improve awareness about soft floor.

Only 30% had not sold under a roof with soft floor. All vendors agreed that their preference was to sell soft floor under a roof. This preference was followed by three other options: 1.) soft floor with no roof, 2.) wet or muddy soft floor, and 3.) concrete floor.

This was only a small straw survey, however the results appear to be consistent with the larger surveys conducted with saleyard owners/managers, buyers and transporters.

5.4 Transporters survey results

We received two responses from transporters and believe both were representative of anecdotal evidence and from the responses provided by the cattle buyers and saleyard owners/managers.

One transporter estimated annual loads from saleyards as 870 and the other 218. Both responded to the survey with exactly the same responses, the transporter with the largest load (“Transporter A”) responded in much more detail, which is summarised below.

Floor surface was an issue for both transporters. The consensus was that tired cattle with sore feet do not travel well, particularly over long distances. One transporter refused to load cattle unless they are taken off concrete and yarded on dirt overnight before loading. ‘Down’ stock (cattle that are lame) give less trouble on soft floor surfaces.

Lameness in cattle was most evident in yards not offering soft floor, and was especially noticeable in older cows and weaner cattle. Transporter A stated that he had not noticed lameness in cattle from saleyards offering soft flooring and the “results speak for themselves”.

When cattle show signs of lameness Transporter A declared, “cattle sit down and get stood on by other cattle, resulting in bruising.” “Cattle will [then] not travel.”

Both transporters named specific saleyards that lameness was a continual problem. These saleyards use concrete floors. One transporter stated that the consequential lameness affected all classes of cattle; the other transporter added that older cattle and weaners were more susceptible. According to both transporters, the time of year had no bearing on lameness.

Both transporters had a clear preference for woodchip. As for the other soft floor materials, Transporter A commented that rubber matting was slippery and that sawdust gets wet and holds too much moisture.

Transporter A believed that respiratory disease was an issue in soft floor yards. The other transporter did not consider it a factor. This issue is handled in section 5.1.3 - “Respiratory Disease”.

In wetter months, if not covered from the weather, yards become muddy and cattle can become cold and tire easily when standing. These cattle are presented dirty and obviously stressed to clients, and drovers and drivers must contend with handling such cattle on slippery and muddy yards.

This is verified by the outcome of dairy research provided in section 4.1- “Animal Health and Welfare” in which it is discussed that dairy cattle require a minimum of 14 hours resting time per day. The model code of practice for the transport of cattle (2002) states that cattle should be fed, watered and rested for at least 12 hours in a loading facility if mustering has caused considerable physical exertion. The National Saleyard Quality Assurance has no guidelines for pen density of any class of cattle.

The transporters’ responses indicated that poorly managed soft floors, which can occur in unroofed saleyards after major rainfall events or poor drainage or roofed yards with poor protection from the shed walls, can lead to cold and tired cattle being transported and showing signs of lameness on trucks.

6 Results and Discussion

All soft flooring options require a sub-base foundation that is a minimum 200mm thick with 100% compaction to avoid any penetration by effluent. This cost will vary on the location of suitable material for the sub-base foundation and associated freight costs. All costs associated with soft floor are related to the surface option used above this sub-base.

6.1 Concrete – the hard floor option

Concrete is not a soft floor but the basis for comparison in this study. Almost all saleyards have some concrete even if just around scales, drafts and ramps. This is the traditional flooring of saleyards and is the benchmark whereby all other surfaces are evaluated in this report.

A saleyard using concrete surfaces is shown in the below photograph.

Photograph 1 – Concrete floor in a saleyard

Concrete generally requires a very solid foundation with a minimum compaction of 100%, 125-150mm thickness and 25mPa strength. It can be reinforced with either fibromesh or steel.

The surface for cattle requires an imprint pressed into the surface of approximately 200x200mm squares or diamonds x 30mm depth and width to reduce slippage where cattle stand or walk.

As stated, concrete is regarded as being a contributing factor to foot soreness, particularly with young cattle and older heavier cows and bulls. It is a preference by all stakeholders for cattle to be left off concrete as long as possible if there is a choice.

The surface of concrete is very conductive to temperature changes, i.e. cold in the winter and hot in the summer.

The effect on lameness is particularly apparent for cattle with soft feet coming off soft, damp pasture.

It is relatively easy to clean with high-pressure hose washdowns, and has a minimal biosecurity risk.

Christer Bergsten (2004) argues that although concrete is a “cheap, strong material for constructions and easy to clean”, lameness and claw horn lesions (sole ulcers, double soles, white line lesions, dermatitis and heel horn erosion) were significantly associated with concrete floors – especially when combined with loose housing systems and poor hygiene.

Canadian researchers Jeffrey Rushen and Anne Marie de Passillé take a more strident anti-concrete stance when they write, “Under no circumstances should dairy cattle be expected to lie on bare concrete. A large survey of several hundred dairy herds in Norway found that simply providing a rubber mat or some litter bedding reduced the incidence of mastitis by 14% compared to cattle kept on concrete floors (Rushen and de Passille).”

We note that surfaces (particularly sawdust, woodchip, straw or any combination of these) placed on top of concrete to create a soft floor saleyard must be thick enough to ensure comfort for animals.

Concrete’s strengths and weaknesses:

Setup costs (including freight), maintenance costs, useful life
Using a concrete surface alone is cheaper than constructing a saleyard with a roof and soft floor. Investment for concrete ranges between $50-60 per square metre, however, with associated drainage costs and effluent management (ranging from sediment separation to storage of treated effluent and irrigation) the investment escalates to a total ranging from $120-160 per square metre, which is higher than many soft floor options. The maintenance costs, if any, are minimal if Australian standards are followed with a thickness of 150mm with the appropriate reinforcement. If this is followed there is a life expectancy of a minimum of 20-30 years.

Cleaning ease and cost
This depends on the age and style of yard layout, however, with modern layouts, mechanical cleaning is possible with mechanised street sweepers or skid steers with sweeper attachments when the weather is fine. In wet or damp conditions, concrete surfaces require washdown to clean which is generally very manual using heavy high-pressure hoses. One yard surveyed sweeps yards with hand brooms weekly and collects solid effluent to reduce water use. Water prices range from recycled storm water with a minimal cost to high value clean water. These water costs range from $40-$200 per mega litre, depending on differing market prices in each state.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
Risk is minimal due to the hygienic habit of the regular washdown/sweeping.

Animal welfare/foot soreness
The greatest weakness in using concrete is an increased likelihood of foot soreness. There has been research highlighting these negative effects. In comparison, it is clear that soft flooring decreases incidence of foot soreness.

Soft flooring improves comfort by making it easier for cattle to stand up and lie down thereby reducing likelihood of knee injuries (Rushen et al, 2001). Table 3 below shows that dairy cattle kept on softer flooring during long-term housing stood up and lay down almost twice as often as cattle on concrete. When they stood up they also stayed standing for longer before lying down again. This suggests that the main advantages of the softer flooring are apparent when the animals are changing position. This conclusion is sourced from a Canadian study that compared lactating dairy cows kept on concrete floors with a small quantity of straw, or dairy cows kept either on geotextile "mattresses" or soft rubber mats. Cattle housed on the mats lay down on average 1.5 hours longer each day. The use of soft mats also halved the incidence of swellings, especially of the front knees, and thus seems likely to reduce the incidence of leg problems. Please note, however, that not all types of rubber flooring are equivalent and therefore as effective. The Canadian study showed that the degree of softness of the floor is particularly important for dairy cows. Possibly the type of rubber used in conveyor belts is too hard (Rushen et al, 2004).

Although this research and a majority of other research into cattle lameness is based on long-term housing of dairy cattle, many animals arriving at most Australian saleyards have no alternative but to remain on concrete from arrival through to leaving after the sale. The research above does have relevance to cattle that following sale are transported onto another hard surface.

Figure 4 Frequency that dairy cows stood up and lay down on a geotextile mattress (Rushen and de Passille)

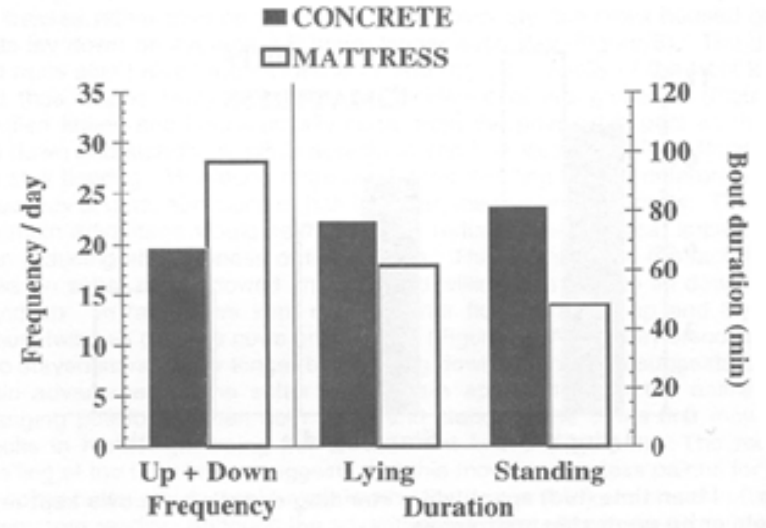


Figure 5. Frequency (mean number of times/day) that cows stood up and lay down and length of time they stayed in that position, for cows kept on concrete floor or geotextile mattresses.

Cattle should have the ability to lie down. Lying reduces wear on feet, assists with thermoregulation and relieves fatigue. Uncovered concrete can become hot in summer and cold in winter and can prevent adequate thermoregulation in cattle forced to stand on concrete during extreme weather. This may promote foot soreness contribute to thermal stress in yarded cattle.

OH&S of saleyard
This is an issue with dragging around heavy hoses under high pressure compared to alternative mechanical options of skid steer machines used in soft floor options.

Potential issues for environmental management
Such issues are generally associated with the effluent system and how it is managed. Many issues associated with concrete revolve around how to manage the ponds in the event of heavy rainfall. Soft floor options that do not require washdown (unlike rubber matting) have a distinct advantage due to the smaller scale of effluent recycling and ponds required.

6.2 Identifying the soft flooring options

Six soft flooring options have been identified. The list below show the percentage of yards studied that use the identified material as their principal flooring option. As mentioned earlier, all comparisons are made against the traditional concrete floor, unless specifically noted.

1. Woodchip 10%
2. Woodchip/Sawdust mix 20%
3. Sawdust 25%
4. Rubber Matting 10%
5. Sand 10%
6. Natural earth/gravel 5%
7. Using concrete only 20%

6.3 Strengths and weaknesses of the options

6.3.1 Woodchip

Cattle buyers rated woodchip as their equal preference (with sawdust) for soft flooring in saleyards.

Woodchip appears to have been first used in 2004 in east central Victoria. Product types in use include pine bark, red gum and a product derived from Council limb clearing, depending on local availability, as well as the use of woodchip in a mix. (See section 6.3.2 – “Woodchip/Sawdust Mix”).

Two saleyards surveyed used woodchip, neither was roofed and both were over existing concrete. Both considered the impact on animal welfare and foot soreness as “very important”.

Cattle buyers stated that woodchip has less dust, is not slippery but can be ‘muddy’. One said that woodchip over concrete “was not the answer”. A point was made that woodchips should not be cut too big - up to 100mm is ideal.

In an outdoor environment woodchips can become quite mushy, and some dust problems were referred to. One saleyard owner said it was easy to renovate or renew with a skid steer with a bucket attachment to collect both woodchip and the associated manure.

The two saleyards using woodchip completely remove the material from April until September and revert to concrete, which is during the higher rainfall months.

No biosecurity risks were quoted, although we note that our chosen survey group may not be as familiar with the risks as a vet or animal health professional.

The life expectancy of woodchip was quoted as 4-18 months; however one saleyard held only irregular store sales, i.e. life expectancy is a function of saleyard throughput.

Woodchip's strengths and weaknesses:

Setup costs (including freight), maintenance costs, useful life
The average set up cost is $7 per square metre within a range of $5-$9 in the survey. This is dependant on freight charges and depth of the material. The annual maintenance cost averaged $5 within a range of $1.50 to $8.40 per square metre. The useful life ranges from 8-10 months and is generally removed during the wetter winter months.

Cleaning ease and cost
This depends on the age and style of yard layout. Modern layouts can use mechanical cleaning with mechanised skid steers and a bucket attachment. As woodchip/sawdust mix is used seasonally in many of the uncovered surveyed yards on an existing concrete surface, the concrete still requires washdown after woodchip/saw dust mix is removed to clean. This is generally very manual labour, using heavy high-pressure hoses. It occurs generally only once a year compared to after each sale with concrete yards.The annual maintenance cost of cleaning is shown above plus the hosing costs during the winter months when woodchip is removed. Water usage savings averaged 50% resulting in reduced pressure on effluent systems. These water costs range from $40-$200 per mega litre, depending on differing market prices in each state.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
This is minimal during dry months when the woodchip is dry, however bacteria will survive in moist conditions. Sawdust is an organic material and can have a significantly higher moisture content, faeces-derived bacteria count (including E coli) than inorganic material such as sand and crushed limestone (Hogan et al. 1989). However the water storage and bacterial count from woodchip is less than for sawdust due to the lower surface area provided by the larger particles.

Animal welfare/foot soreness
The welfare of the cattle is improved when using woodchip over concrete floors and foot soreness is reduced in comparison to concrete if the woodchips are at least 75mm thick with a preference for between 100-150mm deep and the length of the woodchip is less than 100mm. Dairy cattle had a marked preference for walking on woodchips compared to traditional hard earthen dairy tracks in a recent study (Gregory & Taylor 2002).

OH&S of saleyard
Using woodchip improves saleyards' OH&S due to the reduced need to drag around heavy hoses to hose out yards on a regular basis and often weekly. Instead woodchip allows the mechanical usage of skid steers with buckets to clean which is generally once a year. During high rainfall months, washdown is still required for uncovered yards with concrete surfaces when the woodchip is removed.

Potential issues for environmental management
This is generally reduced due to reduced washdown compared with that required for concrete surfaces and although an existing effluent system is in place, it has less pressure due to the reduced water usage. An area must be set aside for the storage of the used woodchip until disposal and replacement woodchip, although this is a short-term logistical management issue. This area may require a containment barrier. Woodchip should be removed from uncovered yards when rainfall increases to prevent bacteria, and can be used as mulch or disposed of at a local landfill.

6.3.2 Woodchip/sawdust mix

Saleyard respondents use a 50% mix of woodchips and sawdust in order to allow for more aeration of the sawdust. An increase in the proportion of sawdust in the mix is likely to result in an increase in the moisture holding potential and an increase in the pathogen load within the floor, especially faeces-derived bacteria such as BJD, E coli and salmonella. The latter two organisms produce disease occasionally in cattle but can cause food poisoning or food infection in humans from consumption of contaminated meat products. There is potential for an increase in the amount of dust generated and this can predispose cattle to BRD and pinkeye.

Three saleyards surveyed were not roofed and one had a roof over handling, delivery and loading yards.

All respondents considered the impact of their flooring on animal welfare and foot soreness as "very important" or "important".

In the case of one yard, a water saving of 100% was claimed for cleaning.

OH&S impact was quoted on average as "improved" due to less slipping by beast and operator when compared to the original concrete surfaces.

Two of the yards in higher rainfall areas completely remove the material from late autumn until early spring and revert to concrete. Three out of four said this flooring mix was easy to clean with a skid steer and bucket.

Two out of the four saleyards quoted biosecurity risk as 'mild' due to the difficulty of drying out after rain. (Although we note that our chosen survey group may not be as familiar with the risks as a vet or animal health professional.)

One saleyard, which was covered in 1988, is still trialling a range of soft floor surfaces. This saleyard prefers woodchip or the mix because it reduces compaction and assists drying. The

same saleyard has recently placed railway iron into a 300mm deep dolomite sub-base with the flat side up which allowed for skid steers to run their bucket attachment along the lengths of the

railway iron as a safety depth guide. This prevented operators from damaging the sub-base. This was being used in the sections that had sawdust and the sawdust-woodchip mix. (This saleyard also reported an inconclusive trial of the volcanic clay material, bentonite. Bentonite, traditionally used to seal dams, can hold 8-10 times its own volume of moisture. In the event of flooding due to trough or pipe leaks, this saleyard now uses straw to absorb surface water and prevent ponding.)

Woodchip/sawdust's strengths and weaknesses:

Setup costs (including freight), maintenance costs, useful life
The average set up cost of this mix is $8.50 per square metre within a range of $2-$19.80. This large variation can partly be explained by the ease or difficulty of access in many existing yards, operational efficiencies, the availability of product and transporting costs. For similar reasons, maintenance cost averaged $8.20 in a range of $1-$19.80 per square metre. The useful life ranges from 7-12 months and when not roofed the mix is removed during the wetter winter months.

Cleaning ease and cost
This depends on the age and style of yard layout. Modern layouts can use mechanical cleaning with mechanised skid steers and a bucket attachment. As woodchip/sawdust mix is used seasonally in many of the uncovered surveyed yards on an existing concrete surface of older yards, the concrete still requires washdown after woodchip/saw dust mix is removed to clean. This is generally very manual labour, using heavy high-pressure hoses. It occurs generally only once a year compared to after each sale with concrete yards.

The annual maintenance cost of cleaning is shown above plus the hosing costs during the winter months when woodchip/saw dust mix is removed. Water usage savings averaged 50% resulting in reduced pressure on effluent systems. These water costs range from $40-$200 per mega litre, depending on differing market prices in each state.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
Risk is minimal during dry months when the woodchip/saw dust mix is dry, however bacteria will survive in moist conditions. Pathogen counts can be very high in floors containing moist sawdust.

Animal welfare/foot soreness
Cattle comfort is improved and using this mix compared to using merely concrete reduces foot soreness. However, the mix must be at least 75mm thick and the length of the woodchip should be less than 100mm.

OH&S of saleyard
OH&S is improved due to being able to use skid steers with buckets to clean generally once a year. During high rainfall months, washdown is still required for uncovered yards with concrete surfaces when the mix is removed. This means dragging around heavy hoses under high pressure for an average 2-3 months per year, compared with a weekly time for cleaning concrete yards with no soft floor.

Potential issues for environmental management

This is generally reduced due to reduced washdown compared with that required for concrete surfaces and with an existing effluent system in place, there is less pressure on the system due to the reduced water usage averaging 75% and up to 100% when the woodchip/sawdust mix is not removed in covered yards. An area must be set aside for the storage of the used woodchips and sawdust and replacement mix, although this is a short-term logistical management issue. This area may require a containment barrier. The mix should be removed when rainfall increases to prevent bacteria, and can be used as mulch or disposed of at a local landfill. Covers or fine screens should be placed over existing drainage points to prevent any woodchip/sawdust mix entering the effluent system.

6.3.3 Sawdust

Sawdust was introduced in 1988 in a covered yard in South Australia and was followed in the 1990s in southern New South Wales. Several types of sawdust products are currently in use. They are largely dependent on local availability, as well as the use of sawdust in a mix. (See section 6.3.2 – “Woodchip/Sawdust Mix”.) Types include native Cyprus pine, plantation pine, green hardwood and red gum. Evaluation of some variations of sawdust is ongoing at all saleyards.

Below is a photograph of a saleyard using sawdust flooring.

Photograph 2 Sawdust floor in a saleyard

Six saleyards were identified that used sawdust. Three were fully roofed, one with a 200mm compacted gravel base, another on compacted clay, and one over existing concrete. Three used it in roofed or partly roofed holding pens and had concrete selling pens.

Costs varied significantly due to the negotiation skills of the individual saleyard operators to market the value of the manure content for compost or garden supplies. In many cases the initial cost was borne by the operator, however the replacement cost was almost neutral. The expansion of the product from installation to replacement due to the manure and moisture content was positive.

Cattle buyers stated that sawdust was their equal top preference (with woodchip) and that it seems to work exceedingly well, but unless used thickly the concrete makes contact with animals' hooves. Data shows sawdust has a density of 225kg/ cubic metre and absorption rate of 2.5kg/kg (Livestock Waste Facilities Handbook, 1993). Only hay has a higher absorption rate, although this was not assessed as an option. Thus sawdust is very efficient in reducing slippage. (Refer to Table 1 in section 4.1 – "Animal Health and Welfare".)

It is uncomfortable for cattle to lie on wet sawdust; hence they stand for longer periods (can be around 12 hours) when the sawdust is wet, resulting in tired animals with sore feet.

Sawdust was said to be slow to dry out and can become muddy, resulting in poor presentation of stock, particularly in high rainfall areas. However it is easy to renovate (i.e. aerate, loosen or turn the material over) using a skid steer and a scarifying attachment. Waterlogged sawdust can have a very high content of gut-derived bacterial pathogens such as E coli, salmonella and BJD bacteria as well as persistent virus such as rotavirus, which can cause enteritis, scours and diarrhoea. Waterlogging provides an opportunity for cattle to drink from puddles thereby promoting the oral transfer of pathogens. Contact with waterlogged surfaces discourages cattle from lying down and may result in wetting of the coat of cattle with subsequent excessive heat loss during cold conditions. Waterlogged and heavily contaminated sawdust as a floor within a saleyard presents an unacceptable risk to animal health, welfare and biosecurity.

Renovating wet or muddy sawdust reduces odour build-up in an anaerobic environment and the possibility of disease survival.

Conversely, when dry it can become dusty, especially in a covered environment where ventilation may be reduced, and cattle buyers report it has created some eye and respiratory problems for stock. Hence there is a need to carefully manage the moisture content of the product. All roofed saleyards surveyed have installed overhead sprinklers at an additional cost, to increase the level of moisture in the soft floor to an arbitrary level where dust is not an issue. The moisture level of sawdust is determined by saleyard management through their own experience.

A roofed facility with sawdust over compacted clay or gravel base was considered as "near perfect" by buyers, yard owners and vendors.

The sawdust needs to be thick enough to prevent hoof contact with the concrete if placed in existing concrete yards, with one recommended depth of 75 mm as a minimum.

Sawdust's strengths and weaknesses:

Setup costs (including freight), maintenance costs, useful life
The average set up cost is $12.30 per square metre within a range of $0.70 to $34.60. Maintenance cost averaged $10.60 in a wide range from $1.10 to $24.00 per square metre. The variations are a result of the management and their negotiation skills to sell the used product at a similar cost as the replacement cost. This was the case with two under-cover saleyards and the only cost was the labour and skid steer cost for removal to outside the shed. The ease or difficulty of access in many existing yards, operational efficiencies, the availability of product and transporting costs also can have a significant impact. The useful life ranges from 6-12 months (one yard felt with proper management it could be indefinite with top up as required). This variation is due to a few factors: the depth, the ability to reduce the moisture level after sales, how well the cattle are curfewed on the home property before delivery to the saleyards, the frequency of maintenance, and the class of cattle that are penned in the particular yards. Yards regularly penning cows have a shorter life range due the amount of manure and urine generated. It is important to regularly monitor the moisture content and to take action to replace sawdust before moisture levels are too high.

Cleaning ease and cost
This depends on the age and style of yard layout, however with modern layouts, mechanical cleaning is possible with mechanised skid steers and bucket attachment. Water usage savings averaged 75%, resulting in reduced pressure on effluent systems, however one operator expressed concern if sawdust found its way into the anaerobic pond and may affect the anaerobic breakdown. This can be avoided by covering all pits with rubber covers.

Sawdust has an absorption rate of 2.5kg/kg and, because of rainfall; most uncovered saleyards removed the sawdust in winter months.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
Survey respondents indicated they considered that disease risk is minimal during dry months when the sawdust is dry, however bacteria will survive in moist conditions. Wet sawdust will harbour many pathogens. A maintenance program based on replenishment of the surface when it becomes waterlogged or when there are more than one to two faecal pats per square metre is required. Unless waterlogging can be prevented, the use of uncovered sawdust based pens is not recommended.

Animal welfare/foot soreness
Cattle comfort is improved and using sawdust compared to using merely concrete reduces foot soreness.

OH&S of saleyard
OH&S is improved due to the mechanical usage of skid steers with buckets to clean generally once a year. During months with heavy rain if the sawdust is removed, washdown is still required for uncovered yards with concrete surfaces. This means dragging around heavy hoses under high pressure for an average 2-3 months per year, compared with a weekly time for cleaning concrete yards with no soft floor.

Potential issues for environmental management
This is generally reduced due to reduced washdown compared with that required for concrete surfaces and although an existing effluent system is in place, it has less pressure due to the reduced water usage of up to 100% and averaging 75%. An area must be set aside for the storage of the used sawdust and replacement sawdust, although this is a short-term logistical management issue. This area may require a containment barrier. Sawdust should be removed when moisture levels increase to prevent bacteria and any anaerobic action creating an odour.

One suggestion has been to use a mix of biodegradable oil and water in the sprinklers to reduce the dust, however trials are still to be conducted.

6.3.4 Rubber matting

This is a new concept in Australian saleyards (only introduced in 2005 in western Victoria) with a wide range of compounds sourced and trialled with variable success and cost. Rubber matting was only seen as an option when upgrading existing concrete floor yards where there was no roof. Possibly half of all Australian cattleyards could use this option.

Rubber matting is the soft floor material that perhaps has been the most tested internationally. In Florida, a 12-month trial in 2002 compared the amount of injuries associated with rubber floors and with concrete floors in milking cows. One half of a feed shed was covered with rubber matting (50mm thick x 1.2m x 1.8m); the other side of the barn stayed concrete. An equal number of cows were on each side and all foot injuries such as foot lesions, swollen knees and hocks were recorded. Nearly 40% of foot injuries were on the side with mats while nearly 60% were on the concrete floor control side, giving a reduction of 22.4% in foot injuries. As for severity, 27% of the affected cows on concrete required antibiotics, whereas 21% of injuries on the rubber matting side received that level of treatment.

Rubber matting was the preferred surface by 25% of cattle buyers surveyed.

Two saleyards were identified that had trialled rubber compound matting in existing open (no roof) concrete selling and holding pens.

The evaluation has identified a compound with relative grip, affordability and a successful proprietary Ramset rivet attaching the compound to the existing concrete floor. This has space between the joint to allow for expansion and contraction due to temperature variation. Failure to provide an adequate joint space had resulted in the edges bending up, creating a potentially dangerous tripping point. This is an important OH&S issue.

Not all the compounds trialed were successful, in one case because the rubber matting became too slippery and dangerous for cattle and handler, and the other case because it was too expensive to be viable.

At one saleyard, the capital cost was funded by sponsorship of each pen by local and national businesses. According to this saleyard manager, increased cattle throughput has been the result of the rubber compound soft flooring being introduced.

Washdown is still required, although this is much quicker due to the ease of moving effluent over the rubber compound versus the difficulty of washing concrete which has more surface resistance.

Some concern was expressed about the inability to clean under the compound and uncertainty about a biosecurity risk harbouring under the compound although there was no clear evidence to suggest that it was a bigger issue than for the other soft floor options. The ability to remove gross contamination before application of a disinfectant chemical is a key component for successful disinfection of a surface. Rubber matting can be hosed clean before application of disinfection thereby increasing efficacy. This is a key advantage provided by rubber matting over other deep litter-based options such as woodchips, sawdust and sand.

The temperature of the rubber compound was discussed, although determining whether there was any difference to concrete floors has not been evaluated. Black rubber will absorb large amounts of heat when exposed to the sun. The heat that is stored may be excessive for exposed rubber in summer and this can result in heat stress in yarded cattle. Rubber has good insulating properties therefore rubber surfaces may allow cattle to regulate body temperature more effectively during winter.

One other saleyard will shortly begin trials of a spray-on crumbed recycled rubber that is coated with a resin type surface.

Rubber matting's strengths and weaknesses:

Setup costs (including freight), maintenance costs, useful life
The set up cost of rubber matting on a large scale has been $35 per square metre secured to the concrete surface and another saleyard has proposed the cost to be $75 per square metre within a range of $30 to $110, as evidenced from the surveys. Suppliers offered early products during the evaluation, but many of the early products were not suitable because of the slippage factor, or they were ruled out for cost benefit purposes. The ideal sizing of rubber matting is longer 30-40 metre rolls, between 1.2-1.5 metres wide to reduce the joins, and 10-12mm thick. The life expectancy ranges from between 5-10 years, as stated by the survey respondents.

Cleaning ease and cost
Water cost is reduced by about 25% due to the ease of washdown, which was still required after each sale. The rubber matting surface is much less abrasive than the concrete and this increases the speed of washdown and reduces water usage. It also makes self-cleaning easier in heavy downpours.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
The risk is believed to be minimal due to the frequency of washdown after each sale. Pathogens that become lodged under the matting will be difficult to remove by hosing or disinfection. However, they are unlikely to provide significant risk of infection to yarded cattle because they are prevented from accessing any of the common routes of infection (i.e. oral, inhalation, wounds). While a build-up of pathogens is unlikely to present a major risk for infection of yarded stock, an excessive build-up of material under rubber matting should be prevented through careful design and construction. Removal of gross contamination under matting (where possible) is required if the build-up is excessive.

Animal welfare/foot soreness
The cattle's' comfort is improved and foot soreness is reduced by using rubber matting over concrete compared with using concrete alone. There has been considerable international research into rubber matting to claim its advantages in increasing cattle welfare.

OH&S of saleyard
This is improved when the preferred rubber compound is chosen which allows for good traction for cattle and handlers. Wash-down is still required with dragging around heavy hoses under high pressure, however it is easier than the washdown of concrete yards.

Potential issues for environmental management
This is generally reduced due to reduced washdown compared with that required for concrete surfaces, with at least 25% water savings, thus placing less pressure on the effluent system.

6.3.5 Sand

Two saleyards were identified that used sand in holding pens; neither was roofed. One considered the impact of their flooring on animal welfare and foot soreness as "very important"; the other did not respond.

No potential environmental management issues or water savings were in the survey, however it is important for ponding of water not to occur and for a fall across the pens of 2-3% to drain surplus in wet weather.

Sand is the preferred surface by only 6.25% of buyers.

However, Bergsten and the Swedish University of Agricultural Sciences and Swedish Dairy Association analysed the locomotion comfort on different surfaces/floors by analysing dairy cow track-ways (measurements of foot prints along a 10 m lane). "When a cow walked on five different surfaces, one after another, she walked most naturally on firm sand. … Decreased step angle (wider posture) and asymmetry in lame cows were most pronounced on slatted concrete and least on sand," writes Bergsten, 2004.

Sand's strengths and weaknesses:

Setup costs (including freight), maintenance costs, useful life
Sand ranged from minimal, with no value given, where sand was in enormous abundance in Western Australia to $44/m3 for 5mm grit. This is approximately $6.60 per square metre at 150mm depth. The life expectancy of this 5mm grit is 12 months and replaced annually. The cheaper and readily available sand in WA is replaced every 6 months.

Cleaning ease and cost
Sand yards are normally not cleaned unless they bog up. If this occurs they may be cleaned 2-3 times per year with a skid steer or front-end loader, although far more care is required with sand than other soft floor types due to its unstable surface. In this way, manure build-up and some sand is trucked out. Washdown is not required for this surface, which would provide a water advantage over concrete and rubber matting surfaces.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
No biosecurity risk was quoted in the survey. Sand offers opportunity to protect microorganisms from sunlight, from desiccation (drying out) and from disinfectant. Whilst sand has been shown to have lower bacterial loads, this load will be greater than for concrete and rubber matting. Again, a regular system of faecal pat removal, pen replenishment and maintenance is required to minimise biosecurity risk.

Sand yards need close monitoring in wet conditions due to its propensity to pond. Bacteria will survive in moist conditions and the survey respondents who used sand had unroofed yards. International research has found sand the best bedding material from a hygienic point of view for long-term indoor housing (Bergsten, 2004).

Animal welfare/foot soreness
The cattle's' comfort is improved and foot soreness is reduced by using this mix compared with using merely concrete. Waterlogged sand provides an animal welfare risk to cattle that are yarded for prolonged periods (12 hours or more), especially in cold weather. Most cattle will want to lie down over a 12-hour period. Waterlogged sand promotes water uptake by the hooves of cattle. Cattle are also unable to see potential penetrating foreign bodies (eg a stone) that may be buried within the wet sand or lie under the surface of water pools. This increases the risk of a penetrating wound to the sole leading to foot abscess. Waterlogging also discourages lying behaviour and cattle that do lie risk hypothermia in cold weather due to wetting of the coat and from loss of body heat into the substrate.

OH&S of saleyard
OH&S impact was quoted in the surveys as "unchanged" but research shows it to be improved due to the mechanical usage of skid steers with buckets to clean compared to wash down of concrete and rubber matting. In months of heavy rainfall, bogging must be minimised through strategic cleaning to reduce potential safety issues for cattle and handlers.

Potential issues for environmental management
Environmental impacts are generally reduced due to no washdown, compared with that required for other surfaces (especially concrete). An area must be set aside for the storage of the used sand containing manure, although this is a short-term logistical management issue. This area may require a containment barrier before being spread on paddocks due to the organic matter content or taken to landfill.

6.3.6 Natural earth/gravel

Almost all saleyards have traditionally had a percentage of natural earth or dirt yards with a gravel base. Two saleyard owners who responded to the survey had roofed yards and a natural earth/gravel surface with no sawdust or woodchip.

Below is a photograph of a saleyard using natural earth/gravel flooring.

Photograph 3 Gravel floor in saleyard

Cattle are normally received into these pens (if there is no other soft floor choice available) prior to drafting and penning and returned to them after the sale for delivery. There are some saleyards with concrete selling pens where cattle are penned until sold. Some transporters prefer cattle are returned to the soft floor pens prior to out loading.

If cattle are fed at saleyards these natural earth/gravel yards are preferred due to their relatively large size, accessibility, ease of cleaning and availability of drinking water.

It is a surface that is very cheap, easy to construct and maintain but it may be limited in wet weather due to ponding and issues with poor drainage if there is not adequate slope in the pens.

Natural earth/gravel's strengths and weaknesses:

Setup costs (including freight), maintenance costs, useful life
The average set up cost is $15 per square metre within a range of $10-$20, according to the small sample of two survey respondents who use earth as their prime soft floor option. This cost is dependant on freight charges and depth of the material. The annual maintenance cost is $0.50 per square metre, stated one respondent. The useful life range is 5-10 years before resurfacing and when under a roof. The majority of unroofed saleyards have a varying percentage of natural/gravel yards. The initial cost may be higher than sand due to the importance of sourcing the correct material, but it is easier to clean than sand and has less maintenance requirements and costs.

Cleaning ease and cost
Earth/gravel yards are normally not cleaned unless they bog up. If this occurs they may be cleaned 2-3 times per year with a skid steer or front-end loader. In this way, manure build-up and

some earth is trucked out. Washdown is not required for this surface, which is an advantage over concrete and rubber matting surfaces.

This process also occurs in the majority of feedlots throughout Australia.

Cleaning ease depends on the age and style of yard layout, however with modern layouts, mechanical cleaning is easier than for sand due to the stability of the earthy surface allowing mechanised skid steers with a bucket attachment to run over the surface cleaning manure without disturbing the foundation. There is no need for water usage for cleaning which is a major advantage and all manure is solid, which is a major saving in comparison to other washdown options. The annual maintenance cost of cleaning (as stated above) is $0.50 per square metre.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
This is minimal during dry months when the manure is dry, however bacteria will survive in moist conditions. The two yards surveyed were both under roof and generally remained dry in the winter. The regular removal of manure will be required to prevent bacterial load from becoming excessive. The prevention of waterlogging and pooling of surface water will be essential to maintain the superior animal welfare aspects of this soft flooring option over existing hard floors.

Animal welfare/foot soreness
An important factor is the choice of gravel. A percentage of clay in natural earth allows it to bind together, which concords with cattle welfare. The gravel must be well drained, be approximately 200mm deep and not contain sharp stones that could injure the cattle's feet. Screened aggregate gravel is unsuitable due to the general sharp stones. It is advisable to ask for professional advice in choosing the appropriate gravel. Gravel within earth/sand becomes especially significant when the substrate is waterlogged. Waterlogged earthen floors (i.e. mud) increase the risk of a penetrating wound to the sole. Cattle prefer to walk on dry, firm (but not hard), non-slippery, level surfaces.

In general, cattle's comfort is improved and foot soreness is reduced by using earth/gravel rather than using concrete.

OH&S of saleyard
This is improved due to the mechanical usage of skid steers with buckets to clean generally once a year. In months of heavy rainfall, bogging and slippage can be minimised by cleaning. Under-cover yards will remain generally safe if a cleaning program is carried out regularly.

Potential issues for environmental management
Since there is no washdown required, issues of this nature are minimal. An area must be set aside for the manure, although this is a short-term logistical management issue. This area may require a containment barrier before being spread on paddocks due to the organic matter content or taken to landfill. A roof is not required for this soft floor option, which is a significant advantage.

7 Strengths and weaknesses of each flooring type

Table 8 showcases the strengths and weaknesses of each of the seven flooring options (including concrete):

Table 8 Strengths and weakness of each soft flooring option compared to a concrete floor

Woodchip	**Setup costs (including freight), maintenance costs, useful life** The average set up cost is $7 per square metre within a range of $5-$9 in the survey. This is dependant on freight charges and depth of the material. The annual maintenance cost averaged $5 within a range of $1.50 to $8.40 per square metre. The useful life ranges from 8-10 months and is generally removed during the wetter winter months. **Cleaning ease and cost** This depends on the age and style of yard layout, however with modern layouts, mechanical cleaning is possible with mechanised skid steers with bucket attachment. As woodchip is used seasonally in many of the uncovered yards. Water usage savings averaged 50% resulting in reduced pressure on effluent systems. These water costs range from $40-$200 per mega litre, depending on differing market prices in each state. **Biosecurity risk (risk of disease spread and transmission between different groups of animals)** This is minimal during dry months when the woodchip is dry, however bacteria will survive in moist conditions. The bacterial load of organic soft flooring such as woodchip increases rapidly when wet and as faecal contamination increases. Regular maintenance, removal of gross contamination and surface replenishment is required to minimise the risk of disease spread. **Animal welfare/foot soreness** The welfare of the cattle is improved when using woodchip over concrete floors and foot soreness is reduced in comparison to concrete if the woodchips are at least 75mm thick with a preference for between 100-150mm deep and the length of the

	woodchip is less than 100mm. **OH&S of saleyard** Using woodchip improves saleyards' OH&S due to reduced need to drag around heavy hoses to hose out yards weekly. Instead woodchip allows the mechanical usage of skid steers with buckets to clean which is generally once a year. During high rainfall months, washdown is still required. **Potential issues for environmental management** This is generally reduced due to reduced washdown compared with that required for concrete surfaces and although an existing effluent system is in place, it has less pressure due to the reduced water usage.
Woodchip/Sawdust Mix	**Setup costs (including freight), maintenance costs, useful life** The average set up cost of this mix is $8.50 per square metre within a range of $2-$19.80. Maintenance cost averaged $8.20 in a range of $1-$19.80 per square metre. Once again, this large variation can partly be explained by the ease or difficulty of access in many existing yards, operational efficiencies, the availability of product and transporting costs. The useful life ranges from 7-12 months and when not roofed the mix is removed during the wetter winter months. **Cleaning ease and cost** This depends on the age and style of yard layout. Modern layouts can use mechanical cleaning with mechanised skid steers and a bucket attachment. As woodchip/sawdust mix is used seasonally in many of the uncovered surveyed yards on an existing concrete surface of older yards, the concrete still requires washdown after woodchip/saw dust mix is removed to clean. The annual maintenance cost of cleaning is shown above plus the hosing costs during the winter months when woodchip/saw dust mix is removed. Water usage savings averaged 50% resulting in reduced pressure on effluent systems. These water costs range from $40-$200 per mega litre, depending on differing market prices in each state.

	Biosecurity risk (risk of disease spread and transmission between different groups of animals) Risk is minimal during dry months when the woodchip/saw dust mix is dry, however bacteria will survive in moist conditions. The bacterial load of woodchip/sawdust floors increases rapidly when wet and as faecal contamination increases. The greater surface area of sawdust over woodchip increases capacity of the mixture to store water and harbour bacteria. Regular maintenance, removal of gross contamination and surface replenishment is required to minimise the risk of disease spread. **Animal welfare/foot soreness** Cattle comfort is improved and using this mix compared to using merely concrete reduces foot soreness. However, the mix must be at least 75mm thick and the length of the woodchip should be less than 100mm. **OH&S of saleyard** OH&S is improved due to being able to use skid steers with buckets to clean generally once a year. During high rainfall months, washdown is still required for uncovered yards with concrete surfaces when the mix is removed. **Potential issues for environmental management** This is generally reduced due to reduced washdown compared with that required for concrete surfaces and although an existing effluent system is in place, it has less pressure due to the reduced water usage averaging 75% and up to 100% when the woodchip/sawdust mix is not removed in covered yards.
Sawdust	**Setup costs (including freight), maintenance costs, useful life** The average set up cost is $12.30 per square metre within a range of $0.70 to $34.60. Maintenance cost averaged $10.60 in a wide range from $1.10 to $24.00 per square metre. The useful life ranges from 6-12 months. It is important to regularly monitor the moisture content and to take action to replace before moisture levels are too high. **Cleaning ease and cost** This depends on the age and style of yard layout, however with modern layouts, mechanical cleaning is possible with mechanised skid steers and bucket

	attachment. Water usage savings averaged 75%, resulting in reduced pressure on effluent systems. Sawdust has an absorption rate of 2.5kg/kg and, because of rainfall; most uncovered saleyards removed the sawdust in winter months. **Biosecurity risk (risk of disease spread and transmission between different groups of animals)** Survey respondents indicated they considered that disease risk is minimal during dry months when the sawdust is dry, however bacteria will survive in moist conditions. The bacterial load of organic soft flooring such as sawdust increases rapidly when wet and as faecal contamination increases. Sawdust has a very high surface area to volume ratio and this enhances capacity to store water and harbour bacteria. Regular maintenance, removal of gross contamination and surface replenishment is required to minimise the risk of disease spread. **Animal welfare/foot soreness** Cattle comfort is improved and using sawdust compared to using merely concrete reduces foot soreness. **OH&S of saleyard** OH&S is improved due to the mechanical usage of skid steers with buckets to clean generally once a year. **Potential issues for environmental management** This is generally reduced due to reduced washdown compared with that required for concrete surfaces and although an existing effluent system is in place, it has less pressure due to the reduced water usage of up to 100% and averaging 75%.
Rubber Matting	**Setup costs (including freight), maintenance costs, useful life** The set up cost of rubber matting on a large scale has been $35 per square metre secured to the concrete surface and another saleyard it is proposed to be $75 per square metre. The ideal sizing of rubber matting is longer 30-40 metre rolls, between 1.2-1.5 metres wide to reduce the joins, and 10-12mm thick. The life expectancy ranges from between 5-10 years, as stated by the survey respondents. **Cleaning ease and cost** Water cost is reduced by about 25% due to the ease of washdown, which was still

	required after each sale. The rubber matting surface is much less abrasive than the concrete and this increases the speed of washdown and reduces water usage. It also makes self-cleaning easier in heavy downpours. **Biosecurity risk (risk of disease spread and transmission between different groups of animals)** The risk is believed to be minimal due to the frequency of washdown after each sale. The ability to remove gross contamination from the surface of rubber matting by hosing allows improved physical removal of pathogens from pens and the effectiveness of disinfection processes compared to other deep litter-based soft floor options. **Animal welfare/foot soreness** The cattle's' comfort is improved and foot soreness is reduced by using rubber matting over concrete compared with using concrete alone. There has been considerable international research into rubber matting to claim its advantages in increasing cattle welfare. **OH&S of saleyard** This is improved when the preferred rubber compound is chosen which allows for good traction for cattle and handlers. Wash-down is still required with dragging around heavy hoses under high pressure, however it is easier than the washdown of concrete yards. **Potential issues for environmental management** This is generally reduced due to reduced washdown compared with that required for concrete surfaces, with at least 25% water savings, thus placing less pressure on the effluent system.
Sand	**Setup costs (including freight), maintenance costs, useful life** Sand ranged from minimal, with no value given, where sand was in enormous abundance in Western Australia to $44/m3 for 5mm grit. This is approximately $6.60 per square metre at 150mm depth. The life expectancy of this 5mm grit is 12 months and replaced annually. The cheaper and readily available sand in WA is replaced every 6 months.

	Cleaning ease and cost Sand yards are normally not cleaned unless they bog up. If this occurs they may be cleaned 2-3 times per year with a skid steer or front-end loader, although far more care is required with sand than other soft floor types due to its unstable surface. **Biosecurity risk (risk of disease spread and transmission between different groups of animals)** No biosecurity risk was quoted in the survey. Sand is inorganic and therefore tends to harbour fewer bacteria than organic soft flooring materials such as sawdust and woodchip. Sand protects bacteria and other pathogens from light, heat, desiccation and from disinfectants. Regular maintenance, removal of gross contamination and surface replenishment is required to minimise the risk of disease spread. Sand yards need close monitoring in wet conditions due to its propensity to pond. Bacteria will survive in moist conditions and the survey respondents who used sand had unroofed yards. **Animal welfare/foot soreness** The cattle's' comfort is improved and foot soreness is reduced by using this mix compared with using merely concrete. **OH&S of saleyard** OH&S impact was quoted in the surveys as "unchanged" but research shows it to be improved due to the mechanical usage of skid steers with buckets to clean compared to wash down of concrete and rubber matting. In months of heavy rainfall, bogging must be minimised through strategic cleaning to reduce potential safety issues for cattle and handlers. **Potential issues for environmental management** Environmental impacts are generally reduced due to no washdown, compared with that required for other surfaces (especially concrete).
Natural earth/gravel	**Setup costs (including freight), maintenance costs, useful life** The average set up cost is $15 per square metre within a range of $10-$20, according to the small sample of two survey respondents who use earth as their

prime soft floor option. This cost is dependant on freight charges and depth of the material. The annual maintenance cost is $0.50 per square metre, stated one respondent. The useful life range is 5-10 years before resurfacing and when under a roof.

Cleaning ease and cost
Earth/gravel yards are normally not cleaned unless they bog up. If this occurs they may be cleaned 2-3 times per year with a skid steer or front-end loader. In this way, manure build-up and some earth is trucked out. Washdown is not required for this surface, which is an advantage over concrete and rubber matting surfaces. The annual maintenance cost of cleaning (as stated above) is $0.50 per square metre.

Biosecurity risk (risk of disease spread and transmission between different groups of animals)
This is minimal during dry months when the manure is dry, however bacteria will survive in moist conditions. The two yards surveyed were both under roof and generally remained dry in the winter. (Although we note that our chosen survey group may not be as familiar with the risks as a vet or animal health professional.) Earth contains both inorganic and organic material and therefore is capable of harbouring bacteria and other pathogens. Whilst this is likely to be less than organic soft flooring materials such as sawdust and woodchip, it provides physical protection for microbes light, heat, desiccation and from disinfectants. Regular maintenance, removal of gross contamination and surface replenishment is required to minimise the risk of disease spread.

Animal welfare/foot soreness
An important factor is the choice of gravel. A percentage of clay in natural earth allows it to bind together, which concords with cattle welfare. The gravel must be well drained, be approximately 200mm deep and not contain sharp stones that could injure the cattle's feet. Screened aggregate gravel is unsuitable due to the general sharp stones. It is advisable to ask for professional advice in choosing the appropriate gravel.

In general, cattle's' comfort is improved and foot soreness is reduced by using earth/gravel rather than using concrete.

	OH&S of saleyard This is improved due to the mechanical usage of skid steers with buckets to clean generally once a year. In months of heavy rainfall, bogging and slippage can be minimised by cleaning. Under-cover yards will remain generally safe if a cleaning program is carried out regularly. **Potential issues for environmental management** Since there is no washdown required, issues of this nature are minimal. An area must be set aside for the manure, although this is a short-term logistical management issue.
Concrete	**Setup costs (including freight), maintenance costs, useful life** Using a concrete surface alone between $50-60 per square metre, however, with associated drainage costs and effluent management (ranging from sediment separation to storage of treated effluent and irrigation) the investment escalates to a total ranging from $120-160 per square metre. The maintenance costs, if any, are minimal if Australian standards are followed with a thickness of 150mm with the appropriate reinforcement. If this is followed there is a life expectancy of 20-30 years. **Cleaning ease and cost** Depends on the age and style of yard layout, however, with modern layouts, mechanical cleaning is possible with mechanised street sweepers or skid steers with sweeper attachments when the weather is fine. In wet or damp conditions, concrete surfaces require washdown to clean which is generally very manual using heavy high-pressure hoses. Water prices range from recycled storm water with a minimal cost to high value clean water. These water costs range from $40-$200 per mega litre, depending on differing market prices in each state. **Biosecurity risk (risk of disease spread and transmission between different groups of animals)** Risk is minimal due to the hygienic habit of the weekly washdown/sweeping. **Animal welfare/foot soreness** The greatest weakness in using concrete is a greater likelihood of foot soreness. There has been research highlighting these negative effects. In comparison, it is

clear that soft flooring decreases incidents in foot soreness.

OH&S of saleyard
This is an issue with dragging around heavy hoses under high pressure compared to alternative mechanical options of skid steer machines used in soft floor options.

Potential issues for environmental management
Such issues are generally associated with the effluent system and how it is managed. Many issues associated with concrete revolve around how to manage the ponds in the event of heavy rainfall and a freak flood event. Soft floor options that do not require washdown (unlike rubber matting) have a distinct advantage due to the smaller scale of effluent recycling and ponds required.

8 Decision Support Tool

How do you use this support tool?

Before using the following decision support tool, it is important to answer the following questions for your situation:

1. What is your budget?
2. Is it Greenfield (a new site) or renovation to existing concrete yards?
3. What are the weather conditions and rainfall events for your chosen site?
4. What is the frequency of sales?
5. Will you have a roof or no roof?

There is no perfect situation and operators should carefully assess their options.

A roof should be a major consideration in any decision to implement soft stand flooring, as it improves the comfort of the cattle and decreases chances of bacteria thriving in moist saleyard floors. To minimise dampness, roofs and walls can stop rain penetration and scarifying or harrowing assists in aeration by rotation. A percentage of woodchip will also assist in aeration of the soft floor. The majority of roofs have been saw toothed which allow for a venturi effect to assist with ventilation. Depending on the location in Australia, meteorological data should be used to determine prevailing winds and penetration of sunlight through the overhang. With gable roofs, ridge vents should be used to assist with ventilation. It is recommended that acoustics data be collected before design is complete.

Additional considerations will be:

- What soft floor option is being considered to reduce foot soreness, improve animal comfort, and minimise animal health issues, all in a safe work environment for people and cattle?
- What are the environmental considerations of the site – minimising effluent?
- What is the expected life span, budget for capital expenditure and annual maintenance?
- Who will design the project that can encompass all these elements with a practical solution?

Levels of Performance – Greenfield / Renovation

It is presumed that new Greenfield sites will be roofed and that concrete will only be used around the high work areas (scales and ramps). If so rubber matting in its current format is not considered an option on its own, without laying on existing concrete floor, as it cannot be easily secured to compacted gravel.

However rubber matting in its emerging form of 10m wide and 100m long rolls may be worth trialling.

A major decision for a Greenfield site is the ability to decontaminate if a disease outbreak were to occur - “Structures that cannot be adequately decontaminated may need to be removed, buried and compensation paid (if available)” states the *Buildings and Structures AUSVETPLAN 1999*.

As a guide, costs have been shown based on figures supplied and depend entirely on each local situation.

As an example, a saleyard with intermittent sales and throughput will have less to spend than those that have a regular weekly market, so they do limited maintenance and will not have roofed their facility.

Table 9 Decision support tool for flooring options (Green denotes superior, yellow denotes medium and red denotes inferior)

	WOODCHIP	WOODCHIP / SAWDUST	SAWDUST	RUBBER MATTING	SAND	NATURAL EARTH GRAVEL	CONCRETE
1 SET UP COSTS (Estimated average cost per square metre based on existing sub base being the same for all surfaces)	$5-9/m^2 SUPERIOR low values based on supply/delivery contracts with garden suppliers	$2-20/m^2 SUPERIOR low values based on supply/delivery contracts with garden suppliers	$1-34/m^2 SUPERIOR low values based on supply/delivery contracts with garden suppliers	$35-75/m^2 MEDIUM ranging to INFERIOR originally $35 with first major development with the second development $75 on existing concrete floor	$5-9/m^2 SUPERIOR low values based on supply/delivery contracts with garden suppliers	$10-20/m^2 SUPERIOR	$50-60/m^2 INFERIOR excluding effluent management $120-160/m^2 including effluent management
2 ANNUAL MAINTENANCE COST (Estimated average cost per square metre)	$2-8/m^2 SUPERIOR low values based on supply/delivery contracts with garden suppliers	$1-20/m^2 SUPERIOR low values based on supply/delivery contracts with garden suppliers	$1-24/m^2 SUPERIOR low values based on supply/delivery contracts with garden suppliers	$1-2/m^2 SUPERIOR Minimal with replacement of	$ 5-9/m^2 1-2 YEAR INFERIOR	$2 / m^2 SUPERIOR	SUPERIOR

	WOODCHIP	WOODCHIP / SAWDUST	SAWDUST	RUBBER MATTING	SAND	NATURAL EARTH GRAVEL	CONCRETE
3 USEFUL LIFE OF SURFACE	9-12 months INFERIOR fully roofed with attention to drying increases life	9-12 months INFERIOR fully roofed with attention to drying increases life	9-18 months INFERIOR fully roofed with attention to drying increases life	5-10 YEARS MEDIUM still being evaluated	6-12 months SUPERIOR due to mechanical skid steer with bucket	5 YEARS MEDIUM	20-30 YEARS SUPERIOR
4 EASE OF CLEANING - RENOVATION	SUPERIOR due to mechanical skid steer with bucket	SUPERIOR due to mechanical skid steer with bucket	SUPERIOR due to mechanical skid steer with bucket	MEDIUM very manual due to need for hosing and/or sweeping	MEDIUM if kept dry, but INFERIOR if wet and boggy	SUPERIOR due to mechanical skid steer with bucket	INFERIOR very manual due to need for hosing and/or sweeping
5 BIO-SECURITY RISK OF DISEASE TRANSFER	MEDIUM if kept dry, but INFERIOR if wet and boggy	MEDIUM if kept dry, but INFERIOR if wet and boggy	MEDIUM if kept dry, but INFERIOR if wet and boggy	SUPERIOR can easily be hosed and disinfected	SUPERIOR if kept dry, but MEDIUM if wet and boggy or high density with no room to lie and rest	MEDIUM if kept dry, but INFERIOR if wet and boggy	SUPERIOR
6 RISK OF FOOT SORENESS	SUPERIOR if kept dry, but MEDIUM if wet and boggy or high density with no room to	SUPERIOR if kept dry, but MEDIUM if wet and boggy or high density with no room to	SUPERIOR if kept dry, but INFERIOR if wet and boggy or high density with no room to	SUPERIOR If kept dry, INFERIOR If wet due to increased risk of slippage and	MEDIUM if dry and not slippery	MEDIUM if kept dry, but INFERIOR if wet and boggy or high	INFERIOR

	WOODCHIP	WOODCHIP / SAWDUST	SAWDUST	RUBBER MATTING	SAND	NATURAL EARTH GRAVEL	CONCRETE
	lie and rest	lie and rest	lie and rest	injury from falling		density with no room to lie and rest	
7 WORKER SAFETY	MEDIUM if dry and not slippery	MEDIUM if dry and not slippery	MEDIUM if dry and not slippery	MEDIUM if dry and not slippery	MEDIUM	MEDIUM if dry and not slippery	SUPERIOR
8 VENDOR RATING	SUPERIOR	SUPERIOR	SUPERIOR	SUPERIOR	MEDIUM	MEDIUM	INFERIOR
9 PURCHASER RATING	SUPERIOR	SUPERIOR	SUPERIOR	SUPERIOR	MEDIUM if dry and not boggy	MEDIUM	INFERIOR
10 ODOUR LEVEL AND FLY INCIDENCE	MEDIUM if dry and not boggy	MEDIUM if dry and not boggy	MEDIUM if dry and not boggy	MEDIUM if dry and INFERIOR if wet under rubber	SUPERIOR if dry and density allows cattle to lie and rest	MEDIUM if dry and not boggy	SUPERIOR

	WOODCHIP	WOODCHIP / SAWDUST	SAWDUST	RUBBER MATTING	SAND	NATURAL EARTH GRAVEL	CONCRETE
11 ANIMAL COMFORT	SUPERIOR if dry and density allows cattle to lie and rest	SUPERIOR if dry and density allows cattle to lie and rest	SUPERIOR if dry and density allows cattle to lie and rest	SUPERIOR if dry and density allows cattle to lie and rest	MEDIUM If sprinklers used before sale to settle dust very beneficial for small particles	SUPERIOR if dry and density allows cattle to lie and rest	INFERIOR
12 DUST LEVELS	MEDIUM sprinklers used before sale to settle dust very beneficial for small particles	MEDIUM sprinklers used before sale to settle dust very beneficial for small particles	MEDIUM sprinklers used before sale to settle dust very beneficial for small particles	SUPERIOR	SUPERIOR minimal amount for sprinklers	MEDIUM sprinklers used before sale to settle dust very beneficial for small particles	SUPERIOR
13 WATER USAGE	SUPERIOR minimal amount for sprinklers INFERIOR if uncovered in winter when reverted back to concrete	SUPERIOR minimal amount for sprinklers INFERIOR if uncovered in winter when reverted back to concrete	SUPERIOR minimal amount for sprinklers INFERIOR if uncovered in winter when reverted back to concrete	MEDIUM due to washdown	SUPERIOR minimal amount for sprinklers	SUPERIOR minimal amount for sprinklers	INFERIOR due to washdown

Figure 5 Greenfield/New Site

Note: This is not in any priority order as all options should be considered for their own specific strengths and weaknesses within your own parameters.

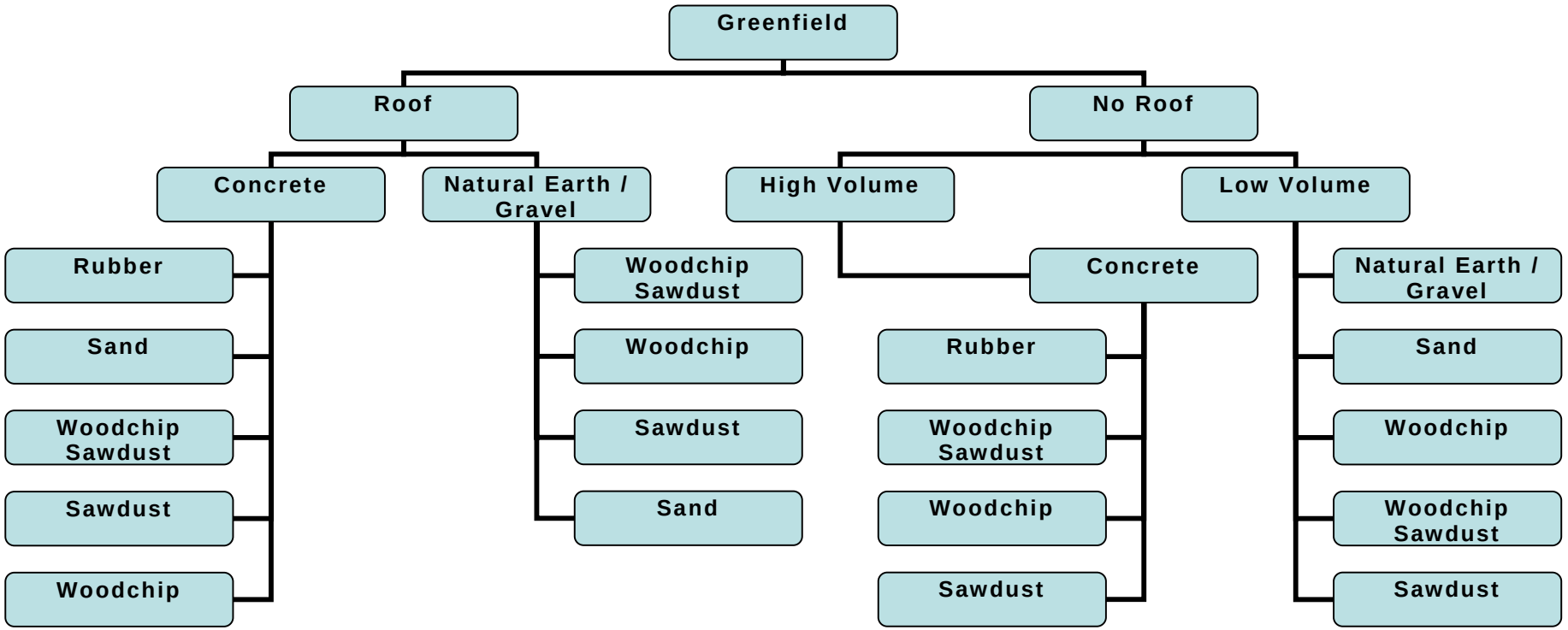
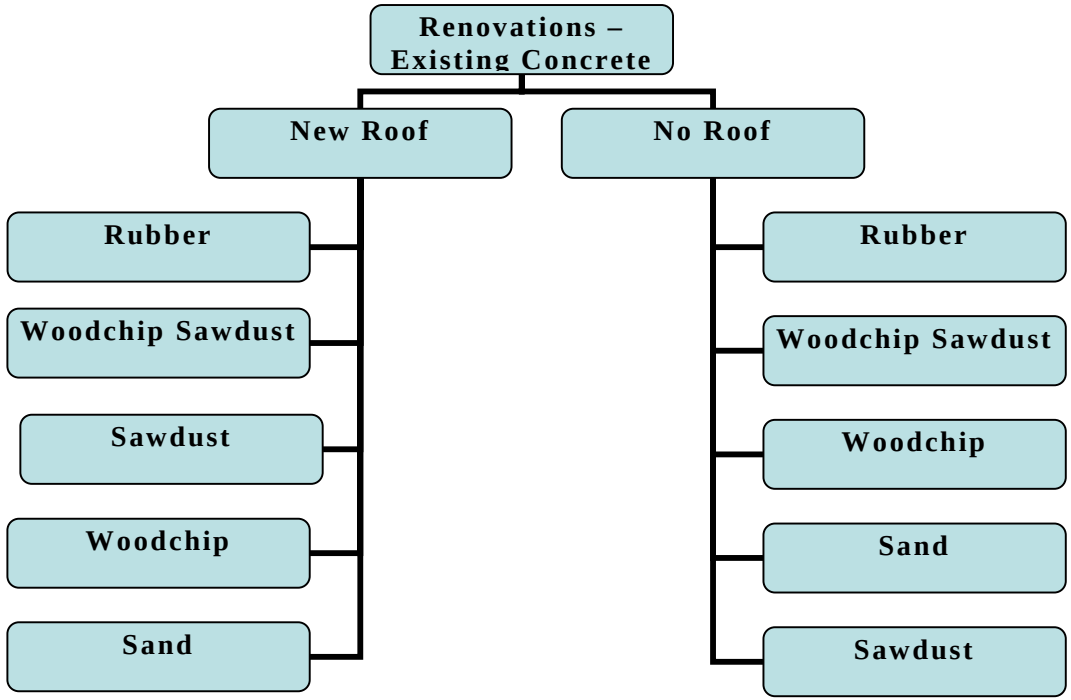


Figure 6 Renovations – Existing Concrete Yards



9 Impact on meat and livestock industry – now and in five years

Feedlotters, and to a lesser extent processors, are already selective about which saleyards they buy from. Feedlotters buy a majority of their cattle direct from vendors thereby bypassing saleyards, which has the advantage of reduced travelling time and minimising animal health issues. For saleyards to become competitive for feedlotters their facilities must be outstanding.

This selectivity will only increase as the saleyard standards are raised, for example in the use of soft flooring to ensure cattle are in optimum condition for transfer to feedlots.

This report should assist saleyard operators/owners to consider their options for use of soft stand flooring and assist them with assessment of their own needs and requirements if considering the use of soft flooring in their yards. It is also apparent from the surveys that the vendors are aware that soft flooring is an option; the degree of awareness and the knowledge of the vendors are going to increase as more yards introduce soft flooring.

The long-term impact may be wider uptake of soft flooring through saleyards in Southern Australia. This could also increase pressure on the current costs of stock sales because of the increased infrastructure costs of the saleyards, particularly where they are roofed.

Water conservation is a positive impact of soft flooring; instead of using large volumes of water to wash down concrete, soft flooring reduces water consumption. The environmental benefit is a better ability to decrease water needs, reduced effluent and therefore a reduction in the potential for environmental impacts from the yards.

10 Success in achieving objectives

Responses by the industry to interviews, surveys and requests for the provision of information has been proactive. However the overall response rate was below expectation, and as such, caution needs to be exercised in drawing conclusions from the information provided. Also not all questions were answered by some survey respondents.

This report extends over a wide geographical region which experiences quite different weather conditions. Evidently the preferred solution in northern NSW may not be so in southern Victoria. However there is sufficient information in our responses to draw a conclusion on the likely role of soft flooring in the future operation of saleyards.

Were the surveys successful in meeting the project's objectives? The surveys were successful to a degree:

The various soft-floor materials in use were identified; and this achieved the first objective.

The second objective to examine the relative benefits and drawbacks of each soft floor material was achieved. The strengths and weaknesses were reported with varying levels of success; some information on relative costs was also reported. Only one respondent provided information on the cost of cleaning the yards so this was supplemented with information obtained from industry participants. Since the animal health and welfare information received in the results lacked detail and the survey respondents were not likely to have the knowledge to be able to comment on this

issue, Richard Shephard, an authority on animal health and biosecurity, provided this information from other sources.

The report was successful in making the link between soft flooring and the improved quality of the cattle and OH&S, and improved working conditions – this information is drawn more from the interviews and research in the area of animal health and welfare than the surveys.

With respect to the third objective of this project, a simple table of the strengths and weaknesses of each flooring material is provided. Similarly, the Decision Support Tool was developed. Due to the limited number of responses received at a detailed level, both of these tend to be partially qualitative rather than quantitative.

11 Conclusions

Scientific research has shown that "stress" is not something abstract, but that it has real, measurable, physiological effects on an animal that can compromise that animal's health, welfare and productivity. These effects are particularly serious when the stress is chronic, or long lasting, as is the case when the stress arises from poorly designed housing environments (Rushen and de Passille). While cattle are generally not held in saleyards for long periods of time, this combined with the transport requirements for stock can have an impact on the level of footsoreness.

Soft flooring assists with providing solutions to stress caused by hard floors, which can lead to tiredness, foot soreness and/or lameness. This is the likely initial reason that saleyard owners will change to a soft floor if they have not already. An additional benefit is an OH&S benefit where soft flooring can assist in the prevention of tired legs for the workers. On the negative side, soft floors can increase the amount of mud in the saleyards. (Hosing is easier to do on a hard floor but rubber matting is also an easy option of washing down and removing and collecting the water.) Concrete uses more water compared to soft flooring options (such as woodchips which absorb waste, resulting in better effluent management). And then there are the capital costs of infrastructure and upkeep costs to consider. It is indicated from our research however that the benefits of correctly managed and maintained soft flooring in saleyards can outweigh the negatives which may occur.

Poorly managed soft floors may present a greater risk to animal welfare and biosecurity than concrete floors. In particular, waterlogged particulate soft floors provide an unacceptable risk to animal welfare and biosecurity. Particulate soft floors cannot be effectively disinfected. The removal of gross contamination will reduce the pathogen load within the material and a maintenance program is essential to control risks. The removal and replenishment of the surface when more than one to two faecal pats are present per square metre, when surfaces become waterlogged or uneven allowing water to pool within surface depressions, or stock are encouraged to eat or drink from the floor is essential.

It depends entirely on the individual needs of the saleyard whether they consider changing to a soft floor. The summary table included in the report outlining the strengths and weaknesses and the Decision Support Tool will assist operators to consider the potential benefits and problems with particular flooring options – this needs to be considered in relation to their own situation i.e.: to the size of the yard, annual turnover, costs, locality (and therefore weather conditions), and what the nature of sales are (slaughter or breeding).

It is clear from our research that saleyards will only survive if they implement best practice and ensure animal welfare is a primary objective. A key example of this is the saleyards that are quality assured under the National Saleyards Quality Assurance (NSQA) system or similar.

Flooring quality and management have a direct effect on foot and leg health and yard hygiene. Foot soreness, lameness and claw lesions can result from excessive exposure to hard and abrasive flooring, particularly if the cattle's feet are not accustomed to the flooring (Rushen, 2004). The Canadian study by Rushen (2004) found that dairy cows not only walk faster on softer surfaces than concrete but also their gait improves. This can also be applied to cattle in Australian saleyards.

Until recently, converting concrete saleyard pens to soft standing has been carried out in a fairly haphazard manner. Many different products have been trialled without a proper assessment. The use of wood-based products such as sawdust, pine, eucalyptus woodchip, and recycled rubber matting has yielded varying results.

Animal welfare and OH&S are two very big challenges facing all operators in the meat and livestock industry. Optimal flooring is the key to decrease foot soreness and lameness in stock. Saleyard floors must aim to provide: a safe environment for man and beast, adequate thermal insulation, an appropriate degree of softness, an appropriate degree of friction, a low risk of abrasion, easy maintenance and cleaning, a low biosecurity risk, and sound effluent management processes.

Broad conclusions drawn about soft flooring relative to concrete flooring include:
- a reduced likelihood of foot soreness and lameness on well maintained soft floors;
- a slight, but manageable, increase to infectious disease risk. This risk can be controlled on well-maintained floors and when pen use on sale days is managed appropriately.
- an improvement in OH&S standards when soft floors are maintained, cleaned and protected from the elements (although some types of rubber matting can become slippery);
- offers real water savings; and
- has generally a lower product cost.

On the other hand, again in the broad context, soft flooring problems compared to concrete flooring may include:
- increased muddiness where yards are not roofed;
- increased dust when it is too dry; and
- increased risk of cattle injury when there is sharp stones in the base gravel, and
- higher maintenance costs if removing the product for winter (some soft flooring options can be used 12 months of the year).

Overall, soft flooring's strengths when correctly managed and maintained outweigh any potential weaknesses, especially when the moisture content of the flooring is carefully monitored, thereby eliminating dust or mud issues.

Our investigation has indicated that the sixteen cattle buyers surveyed prefer to buy stock from a saleyard with a soft standing floor, and currently, sawdust and woodchip are the two most favoured saleyard floor surfaces. However this may be because 11 of the 20 saleyard owner/operator respondents used sawdust or woodchip flooring so this may be the material most people are familiar with. Saleyard operators also prefer soft flooring, as cattle are fresher, move more freely and travel well after being held on soft flooring. The importance of the impact soft flooring has on foot soreness was rated very highly by respondents and concrete was regarded as being a contributing factor to foot soreness, particularly with young cattle and older heavier cows and bulls. In many southern Australian saleyards a large proportion of cattle throughput is made up of weaner cattle and it is

mostly from these sales that the reported incidences of foot soreness occurs, leading to buyers demanding soft flooring.

12 Recommendations for saleyard owners and operators

The survey results confirmed that a roofed facility with sawdust over compacted clay or gravel base was considered as “near perfect” by buyers, yard owners and vendors. Others argued for woodchip because it is easier to dry. Yet others stated that woodchip/sawdust mix was the best material due to the increased aeration. It may be that rubber flooring is a better all round flooring once people become familiar with it on exiting concrete saleyards.

No matter which material works best for each saleyard, owners must ensure that (if required) the saleyard has a roof, walls, regular maintenance and cleaning. Walls along the edge of the roofing ensure that wet weather does not penetrate on to the floor surface. However this can also reduce the ventilation and airflow which can increase dust issues. Most survey respondents and industry commentators rate roofing as just as important as soft flooring as they complement one another. As earlier discussed, dry flooring is also important for improving hoof health (Rushen, 2004). Our surveys showed that a roofed facility with sawdust over compacted gravel base was considered as “near perfect”. This sawdust needs to be thick enough to prevent hoof contact with the concrete if placed in existing concrete yards, with a recommended depth of 75 mm.

There is no doubt that while a roofed, sawdust floored saleyard can be beneficial, it is up to the individual owner to make their own decision about upgrading to soft floor. To do so they must consider their location, weather conditions, finances, and the volume of cattle – important for the number of cattle sales they make in a year and how many sales events they hold per year. The size of the yard is also important – the bigger the yard the more it costs to improve it. It is also important to note that correct maintenance and cleaning is required to minimize the disease risks which can occur with soft flooring systems.

The saleyard industry should develop a more comprehensive guideline on pen densities and adhere to recommended space allowances for penned livestock irrespective of the flooring type so that cattle receive adequate rest and minimise the risk that they are tired during transport. Overcrowding of pens can also increase the incidence of lameness.

Soft flooring needs to be seen within the bigger context of the saleyard’s efficiency and human and animal safety and comfort. Soft flooring in some form looks to be here to stay and if a saleyard cannot provide suitable soft flooring, this saleyard may risk losing market share. It is important to note that soft floor is only one component in the mix of best practice for saleyard operations.

13 Appendices

13.1 Appendix 1 – Saleyard user cover letter and survey

Re: Review of Soft Flooring Options for Saleyards

A range of floor surfaces, including concrete, sawdust, woodchips etc are used in cattle Saleyards throughout Australia. Their use is based on a number of factors including initial cost, maintenance cost, ease of cleaning, suitability to local conditions and animal throughput.

Meat and Livestock Australia (MLA) has appointed Livestock Exchange Consultancy, specialist Saleyard Consultants, together with Atlex Stockyards and Scanclear Pty Ltd, to conduct a Review of the Soft Flooring Options for Saleyards.

It is important that the issues surrounding Soft Flooring are fully understood, a clear policy developed and benefits promoted, within the livestock industry.

MLA has three objectives for us to explore:

a. Identify the various options of soft flooring available
b. Strengths and weaknesses of each option including costs, biosecurity risk, animal welfare, OH&S and environmental issues
c. Recommendations for a future direction

We would appreciate your valuable input, (even if your Saleyard does not have soft flooring!)
It will be an important part of putting the Review together.

Please take the time to assist us in addressing the various issues by answering as many of the questions on the enclosed survey form as possible and returning it to us, preferably by email, or at the address below, or by fax prior to -

Friday June 16, 2006.

To

LIVESTOCK Exchange Consultancy
771 Sidonia Rd, Kyneton 3444

Ph: 03 5423 7243 Fax: 03 5423 7109

Email: saleyardconsultants@bigpond.com

We appreciate your valuable time and thank you for your anticipated response.

SURVEY OF SALEYARD USERS

Business Name _____

1. How many livestock would you normally buy in a year in the following categories?

Livestock Type	**Number**
Cows	
Heifers	
Steers	
Calves under 1 year	
Bullocks/Ox	
Bulls	
CATTLE TOTAL	

2. How many times have you used saleyards to buy livestock in the last twelve months?

SALEYARD	**NO. OF TIMES BOUGHT**	**TOTAL NO.**

*Do you wish to comment?*_____

3. Is soft standing in saleyards an issue for your business?

- ❑ Yes, always
- ❑ Sometimes
- ❑ No, never

Please comment _____

4. (a) Would you prefer to buy cattle from saleyards offering soft standing?

Yes No ***(Circle one)***

(b) Why?

Please comment _____

_____

5. (a) During times of plentiful supply of cattle do you preferentially buy from yards offering soft standing?

Yes No ***(Circle one)***

(b) If No, why not?

Please Comment _____

6. Lameness in cattle sold through saleyards is an issue which has been raised publicly and has been associated with hard concrete flooring.

Have you noticed lameness in cattle in saleyards **not** offering soft flooring?

Yes No ***(Circle one)***

Please comment _____

_____

7. Have you purchased cattle showing signs of lameness?

Yes No ***(Circle one)***

If so then,

(a) Were there any negative consequences? Yes No ***(Circle one)***

(b) Is the lameness problem associated with specific yards? Yes No ***(Circle one)***

(c) If yes, which yards? _____

(d) Is the problem more common in specific classes of cattle? Yes No ***(Circle one)***

(e) If so, which classes are more susceptible? _____

(f) Is the problem more common at different times of the year? _____

(g) If so, when? _____

8(a) There is a range of soft flooring options offered by saleyards. Do you have a preference?

(Circle one) Sawdust Woodchip Rubber Matting Dirt/gravel Sand Grating

(b) Why do you have that preference?

Please comment _____

_____

9. Do you believe respiratory disease is a problem in soft floored saleyards?

Yes No ***(Circle one)***

10.(a) Do you believe there are any other problems with the different soft surfaces offered?

Yes No ***(Circle one)***

(b) If so, what are they?

Please comment _____

_____

10. Some of the soft flooring options appear to create a lot of mud in the yards during the wetter months. Does this cause a problem in cattle purchased by you under these conditions?

_____

11. Are there any other points you would like to raise on the issue of soft flooring?

_____

_____

THANK YOU VERY MUCH FOR YOUR VALUABLE TIME, AND CO-OPERATION, IN COMPLETING THIS SURVEY.

Livestock Exchange Consultancy
771 Sidonia Rd, Kyneton 3444

Ph: 03 5423 7243 Fax: 03 5423 7109

Email: saleyardconsultants@bigpond.com

13.2 Appendix 2 – Letter to the industry groups and list of contributors to this report

Re: Review of Soft Flooring Options for Saleyards

A range of floor surfaces, including concrete, sawdust, woodchips etc are used in cattle Saleyards throughout Australia. Their use is based on a number of factors including initial cost, maintenance cost, ease of cleaning, suitability to local conditions and animal throughput.

Meat and Livestock Australia (MLA) has appointed Livestock Exchange Consultancy, specialist Saleyard Consultants, together with Atlex Stockyards and Scanclear Pty Ltd, to conduct a Review of the Soft Flooring Options for Saleyards.

It is important that the issues surrounding Soft Flooring are fully understood, a clear policy developed and benefits promoted, within the livestock industry.

MLA has three objectives for us to explore:

a. Identify the various options of soft flooring available
b. Strengths and weaknesses of each option including costs, biosecurity risk, animal welfare, OH&S and environmental issues
c. Recommendations for a future direction

We would appreciate your valuable input as a vital part of a key industry group.

Please take the time to assist us in addressing the various issues by answering as many of the questions on the enclosed survey form as possible and returning it to us, preferably by email, or at the address below, or by fax prior to -

Friday June 16, 2006.

To

LIVESTOCK Exchange Consultancy
771 Sidonia Rd, Kyneton 3444

Ph: 03 5423 7243 Fax: 03 5423 7109

Email: saleyardconsultants@bigpond.com

We appreciate your valuable time and thank you for your anticipated response.

List of Contributors

Personal communication and written text

- Bruce Knee
- Simon Lott

Saleyard users

Saleyard user surveys were sent to the following organisations for distribution to their members :-

1. Australian Livestock and Property Agents Association Ltd – southern zone.
2. Australian Livestock and Property Agents Association Ltd – NSW zone.
3. Australian Lot Feeders Association.
4. Australian Meat Industry Council.
5. Cattle Council of Australia.
6. VFF Livestock.

Individual surveys were distributed to the following:-

- Graeme Ward — Cattle buyer.
- Mick Kemp — " "
- Geoff Howell — " " (O'Connor's)
- Denis Henderson — " "
- Conroy Bros — Feedlotter
- Steven Reynolds — Feedlotter
- Dick Cameron — Agent
- Charles Medland — Agent
- Hamish Browning — Agent (Elders Ltd)
- Dan Ivone — Agent (Paull & Scollard)
- Teys Bros — Abattoirs

Saleyard owner/managers

Individual personal interviews were conducted with the managers or representatives of the following saleyards:-

Alexandra	Bendigo	Camperdown
Colac	Deniliquin	Euroa
Hamilton	Horsham	Korumburra
Kyneton	Leongatha	Midland WA
Shepparton	South Australian Livestock Exchange	Wangaratta
Warragul	Warrnambool	

Saleyard Owner/Managers

Individual personal interviews were conducted with the managers or representatives of the following saleyards, using the *saleyard manager/owner survey form* as the basis of interview:-

Alexandra	Bendigo	Camperdown
Colac	Deniliquin	Euroa
Hamilton	Horsham	Korumburra
Leongatha	Midland WA	Shepparton
South Australian Livestock Exchange	Wangaratta	Warragul
Warrnambool		

Saleyard owner/manager survey forms were sent to all other cattle Saleyards with a known email address in the Southern Beef Zone.

Bairnsdale	Ballarat	Bendigo
Casterton	Cobram	Corryong
Echuca	Kerang	Kyneton
Mansfield	Mildura	Pakenham (V.L.E)
Swan Hill	Dublin (S.A.L.E)	Millicent
Mt Compass	Mt Gambier	Naracoorte
Launceston	Powranna	Boyanup
Midland	Great Southern	Armidale
Bathurst	Bega	Camden
Casino	Cooma	Coonamble
Cootamundra	Corowa	Cowra
Deniliquin	Dorrigo	Dubbo
Dunedoo	Finley	Forbes
Glen Innes	Glouster	Goulburn
Grafton	Griffith	Gundagai
Gunnedah	Inverell	Kempsey
Lismore	Maitland	Mooree
Moss Vale	Mudgee	Narribri
Nowra	Orange	Scone
Singleton	Tamworth	Taree
Tenterfield	Tumut	Wagga
Windsor	Yass	Young

Others Contacted

- Duncan Rowland – Animal Health Australia.
- Bill Woonton – DPI Victoria, Benalla.
- Tristan Jubb – DPI Victoria, Bendigo.
- David Pollock – Livestock Saleyards Association of Australia.
- Patrick O'Halloran – VFF Livestock.
- Ian O'Loan – National Saleyards Quality Assurance Ltd.
- Jenny Kelly – Weekly Times.
- Murray Arnell – Rural Press/Stock and Land

The assistance and cooperation of all contributors to this report, in particular saleyard management, is gratefully acknowledged.

13.3 Appendix 3 – Saleyard owner/manager survey

SURVEY OF SALEYARD OWNERS/MANAGERS

Name of Saleyard_____

SECTION A

1. How many cattle are normally sold through your Saleyards in a 12 months period, in the following categories?

Livestock Type	**Number**
Cows	
Heifers	
Calves under 1 year	
Steers	
Bullocks/Ox	
Bulls	
CATTLE TOTAL	

2.
2.1. Describe the exact type of soft standing material used at your Saleyard.

_____

2.2 When was it first installed? _____

3. What was the initial set up cost, (include material, freight, labour and any other set up costs).

3.1 Per square metre **$**_____ **3.2** No. of square meters_____ =

3.3 Total cost **$**_____

Do you wish to comment? _____

_____

4. What are the annual maintenance costs?

MAINTENANCE ITEM	**$**

5.

5.1 What is the useful life of your soft flooring material?

(If it has not been replaced as yet please provide a carefully considered estimate)

	Cows	Heifers	Calves	Steers	Ox	Bulls
4 months						
6 months						
9 months						
12 months						
18 months						

It is understood that some saleyards replace the soft standing material in the cow yards a lot more than the weaner yards due to the volume of the urine.

Please comment _____

_____

5.2 Do you have a roof? YES / NO ***(Circle one)***

5.3 If so what type?

- ❑ Saw tooth
- ❑ Gable
- ❑ Dome

5.4 If you have a roof, how do you protect the edges of the soft floor under the roof from the weather?

Please comment _____

5.6 What sub base do you have under the soft floor?

- ❑ 200mm compacted gravel
- ❑ Existing concrete floor
- ❑ Other (please describe)

6.

6. 1. How would you describe the cleaning or renovating ability of your soft flooring material?

- ❑ Quite easy
- ❑ Somewhat easy
- ❑ A little difficult
- ❑ Difficult
- ❑ Hard

6.2. Please describe the cleaning procedures required to keep your soft flooring material in good condition from an animal welfare and environmental viewpoint.

Please comment _____

6.3. If your soft floor is bark, sawdust or similar –

6.3.1 Do you renovate/ aerate it? YES / NO ***(Circle one)***

6.3.2 Why do you renovate? _____

6.3.3 How do you renovate it? _____

6.3.4 How often? _____

7. Do you consider there are any biosecurity risks involved with the use of your soft flooring material?

(This may involve the potential for disease spread and/or transmission between different groups of animals)

- ❑ No
- ❑ Mild risk
- ❑ Yes

Do you wish to comment? _____

8. How would you describe the impact that installation of soft flooring has had on Animal Welfare issues, in particular foot soreness?

Please circle one. *Very Important Important Of little use Irrelevant*

Please Comment _____

9.

9.1 Has it reduced the labour requirements in the management of your yards? YES / NO ***(Circle one)***

9.2 If so, by how much? _____*% or litres*

10. What impact has it had on the noise level?

- ❑ Quieter
- ❑ No change
- ❑ Not as quiet
- ❑ Noisy

11. What has been the impact on Occupational Health& Safety (Worksafe) standards of workers in your saleyard?

(please tick one)

- ❑ Much improved
- ❑ Improved
- ❑ No change
- ❑ Not as good

Please Comment _____

12. What about odour?

Please comment _____

13. Are there more flies? YES / NO ***(Circle one)***

*Do you wish to comment?*_____

14.

14.1 Has there been a saving in water usage? YES / NO ***(Circle one)***

14.2 If so, how much? _____*%*

15. Describe the potential issues for environmental management that your soft flooring has highlighted.

Please comment _____

SECTION B

This section of the questionnaire refers to perceptions.

Briefly describe what feedback you receive from:

- Vendors

_____

_____

- Agents

_____

_____

- Buyers

_____

_____

- Transport operators

_____

_____

- Yard drovers

_____

_____

- In an ideal world, what would you like regarding soft floor?

_____

_____

(If you require more space to fully answer a question, please write your comments below, referring to the Item #, i.e. 4.1.)

_____

_____

THANK YOU VERY MUCH FOR YOUR VALUABLE TIME, AND CO-OPERATION, IN COMPLETING THIS SURVEY.

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13.4 Appendix 4 – Saleyard vendor survey

(The following was a verbal survey)

Questions

1. How many cattle in a year do you sell?
2. What % of sales go direct to a) Slaughter
   b) Feedlotter
   c) Saleyard
3. Do you consider beef sales as your main income source? Yes / No
4. Do you prefer to sell through soft floored saleyards? Yes / No
5. Do you consider soft floored saleyards a must for feature weaner sales? Yes / No
6. Is Animal Welfare a big issue? Yes / No
7. Should more be done to improve awareness? Yes / No
8. Have you sold cattle in a roofed yard? Yes / No
9. Do you get value for your $ out of saleyard yard dues? Yes / No
10. Rate the following saleyard floor options in order of best = 1, worst=4
    a) Soft stand roofed yard b) Soft stand no roof c) Wet or muddy soft stand
    d) Concrete yards.

13.5 Appendix 5 – Australian Standards for the Export of Livestock - Minimum pen area per head for cattle exported by sea

Table A4.1.1 Minimum pen area per head for cattle exported by sea — default table

Liveweight (kg)b	Minimum pen area (m2/head)	Liveweight (kg)b	Minimum pen area (m2/head)	
			Voyages of 10 days or morec	Voyages of less than 10 daysc
200 or less	0.770	405	1.467	1.459
205	0.787	410	1.484	1.468
210	0.804	415	1.501	1.487
215	0.821	420	1.518	1.505
220	0.838	425	1.535	1.519
225	0.855	430	1.552	1.533
230	0.872	435	1.567	1.547
235	0.889	440	1.586	1.560
240	0.906	445	1.603	1.574
245	0.923	450	1.620	1.588
250	0.940	455	1.637	1.602
255	0.957	460	1.654	1.615
260	0.974	465	1.671	1.629
265	0.991	470	1.688	1.643
270	1.008	475	1.705	1.657
275	1.025	480	1.722	1.670
280	1.042	485	1.739	1.684
285	1.059	490	1.756	1.698
290	1.076	495	1.773	1.712
295	1.093	500	1.790	1.725
300	1.110	505	1.807	1.739
305	1.127	510	1.824	1.753
310	1.144	515	1.841	1.767
315	1.161	520	1.858	1.780
320	1.178	525	1.875	1.794
325	1.195	530	1.892	1.808
330	1.212	535	1.909	1.822
335	1.229	540	1.926	1.835
340	1.246	545	1.943	1.849
345	1.263	550	1.960	1.863
350	1.280	555	1.977	1.877
355	1.297	560	1.994	1.890
360	1.314	565	2.011	1.904
365	1.331	570	2.028	1.918
370	1.348	575	2.045	1.932
375	1.365	580	2.062	1.945
380	1.382	585	2.079	1.959
385	1.399	590	2.096	1.973
390	1.416	595	2.113	1.987
395	1.433	600	2.130	2.000
400	1.450	more than 600 d e		

a Pen-group liveweight range: the liveweight range in each pen of cattle should not exceed the pen average plus or minus 50 kg.

b For cattle weighing between 200 kg and 600 kg, for weights between those shown in the table, the minimum pen area per head should be
calculated by linear interpolation.
c Time from completion of loading in Australia until anticipated arrival at the first port of discharge overseas.
d For cattle weighing more than 600 kg, on voyages of 10 days or more, the minimum pen area per head is 2.13 m2 plus 0.017 m2 for each 5 kg
above 600 kg.
e For cattle weighing more than 600 kg, on voyages of less than 10 days, the minimum pen area per head is 2.00 m2 plus 0.014 m2 for each 5 kg
above 600 kg.

Table A4.1.2 Minimum pen area per head for cattle exported by sea from a port south of latitude 26 degrees south, from 1 May to 31 October

Liveweight (kg) a	Minimum pen area (m2/head)	Liveweight (kg) a	Minimum pen area (m2/head)
200 or less	0.847	355	1.427
205	0.866	360	1.445
210	0.884	365	1.464
215	0.903	370	1.483
220	0.922	375	1.502
225	0.941	380	1.520
230	0.959	385	1.539
235	0.978	390	1.558
240	0.997	395	1.613
245	1.016	400	1.668
250	1.034	405	1.688
255	1.053	410	1.707
260	1.071	415	1.727
265	1.090	420	1.746
270	1.109	425	1.766
275	1.128	430	1.785
280	1.146	435	1.805
285	1.165	440	1.824
290	1.184	445	1.844
295	1.203	450	1.863
300	1.221	455	1.883
305	1.240	460	1.902
310	1.258	465	1.922
315	1.277	470	1.941
320	1.296	475	1.961
325	1.315	480	1.980
330	1.333	485	2.000
335	1.352	490	2.019
340	1.371	495	2.039
345	1.390	500	2.060
350	1.408	More than 500	b

a For cattle weighing between 200 kg and 500 kg, for weights between those shown in the table, the minimum pen area per head should be calculated by linear interpolation.
b For cattle weighing more than 500 kg, the minimum pen area per head is 2.06 m2 plus 0.02 m2 for each 5 kg above 500 kg.
Note: For shipments that originate or load from a port south of latitude 26 degrees south and take a route that does not cross latitude 15 degrees south, stocking densities will be calculated from Table A4.1.3 regardless of the date of the voyage.

Table A4.1.3 Minimum pen area per head for cattle exported by sea from a port south of latitude 26 degrees south, from 1 November to 30 April

Liveweight (kg)a	Minimum pen area (m2/head)	Liveweight (kg)a	Minimum pen area (m2/head)
200orless	0.770	380	1.382
205	0.787	385	1.399
210	0.804	390	1.416
215	0.821	395	1.433
220	0.838	400	1.450
225	0.855	405	1.467
230	0.872	410	1.484
235	0.889	415	1.501
240	0.906	420	1.518
245	0.923	425	1.535
250	0.940	430	1.552
255	0.957	435	1.569
260	0.974	440	1.586
265	0.991	445	1.603
270	1.008	450	1.620
275	1.025	455	1.637
280	1.042	460	1.654
285	1.059	465	1.671
290	1.076	470	1.688
295	1.093	475	1.705
300	1.110	480	1.722
305	1.127	485	1.775
310	1.144	490	1.827
315	1.161	495	1.880
320	1.178	500	1.932
325	1.195	505	1.984
330	1.212	510	2.035
335	1.229	515	2.086
340	1.246	520	2.137
345	1.263	525	2.157
350	1.280	530	2.176
355	1.297	535	2.196
360	1.314	540	2.215
365	1.331	545	2.235
370	1.348	550	2.255
375	1.365	More than 550 b	

a For cattle weighing between 200 kg and 550 kg, for weights between those shown in the table, the minimum pen area per head should be calculated by linear interpolation.
b For cattle weighing more than 550 kg, the minimum pen area per head is 2.255 m2 plus 0.02 m2 for each 5 kg above 550 kg.
Note: For shipments that originate or load from a port south of latitude 26 degrees south and take a route that does not cross latitude 15 degrees south, stocking densities are to be calculated from Table A4.1.3 regardless of the date of the voyage.
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